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Superfund Record of Decision (EPA Region 5)
Wauconda Sand and Gravel, IL. (Second Remedial Action)
March 1989

(U.S.) Environmental Protection Agency, Washington, DC

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Superfund Record of Decision:

Wauconda Sand & Gravel, IL

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16. Abstract (Limit: 200 words)

The 74-acre Wauconda Sand & Gravel site includes 52 acres of permitted and unpermitted landfill areas and is located in Lake County, Illinois, north of the village of Wauconda. The area neighboring the site includes agricultural land, residential properties including 12 homes within 1 mile of the landfill, and 2 new residential developments. Most residences use well water but the wells lie outside the ground water flow boundaries of the moderately contaminated shallow aquifer, which lies directly beneath the site. A deeper aquifer, which is connected to the shallow aquifer and is the predominant source of drinking water for area residents, does not appear to be contaminated. From 1941 to mid 1978, the site owner accepted primarily nonhazardous municipal, residential, commercial, and industrial wastes; there are, however, an estimated 30,000 yd^3 of hazardous wastes onsite. The landfill was closed in July 1978 and was subsequently covered by a layer of clay and soil. Since the late 1970s leachate has been discharging to a nearby creek, and surface water sampling taken from this creek has revealed low concentrations of VOCs, PCBs, and metals. In a 1985 Record of Decision (ROD) EPA determined that a leachate collection system was needed to prevent further ground water contamination. This ROD, the second and final operable unit, further characterizes ground water quality via long-term monitoring to ensure that existing measures are protective of human
(See Attached Sheet)

17. Document Analysis a. Descriptors

Record of Decision - Wauconda Sand & Gravel, IL
Second Remedial Action - Final
Contaminated Media: gw, sw, air
Key Contaminants: VOCs (vinyl chloride, benzene), metals (arsenic, lead), methane

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages ~~107~~ 113
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16. Abstract (Continued)

health and the environment. The primary contaminants of concern affecting the ground water, surface water, and air are VOCs including vinyl chloride and benzene; metals including arsenic and lead; and methane.

The selected remedial action for this site includes long-term monitoring of ground water, surface water, and air emissions with possible evaluation of additional remedial alternatives and a ROD amendment if action levels are exceeded; further upgrade of the site cap and possible relocation of a nearby creek; installation and operation of an improved venting system with possible air emissions treatment; continued operation and/or maintenance of the leachate collection and venting systems, site cap, fence, and monitoring well network; and implementation of institutional controls to restrict ground water use. The estimated present worth cost for this remedial action is $12,155,606, which includes annual O&M costs of $174,500.

DECLARATION FOR RECORD OF DECISION
REMEDIAL ALTERNATIVE SELECTION

SITE Wauconda Sand & Gravel Site
Wauconda, IL

STATEMENT OF BASIS AND PURPOSE

This decision document presents the remedial action for the Wauconda Sand & Gravel Site in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986, (SARA), and the National Oil and Hazardous Substance Pollution Contingency Plan, 40 CFR Part 300, November 20, 1985.

The State of Illinois (through the Illinois Environmental Protection Agency) has been provided an opportunity to comment on the technology and degree of treatment proposed by the Record of Decision and has concurred with the selected remedy.

STATEMENT OF BASIS

This decision is based on the administrative record for the Wauconda site. The attached index (Appendix) identifies the items which comprise the administrative record.

DESCRIPTION OF SELECTED REMEDY

This is the final of two operable units for this site. The first operable unit addressed the release of leachate to Mutton Creek, the direct contact threat via groundwater and air emissions and took measures to reduce infiltration through the site cover. These were addressed by implementation of the following remedial measures:

- Installation of leachate collection drains to stop surface leachate discharge into Mutton Creek;
- Provision for leachate disposal at Wauconda sewage treatment plant, if acceptable, or at a hazardous waste treatment facility;
- Regrading of settled, depressed and eroded areas on the existing landfill soil cover with sufficient slope to promote and control rain runoff. This was to eliminate ponding and reduce infiltration;
- Revegetation of bare and eroded areas to prevent erosion of soils into Mutton Creek, and exposure of landfill materials;

- Construction of a fence around the site to prevent human contact with gas vents and the leachate collection system.

Because the groundwater data was inconclusive, a decision on the remedial action for the groundwater was deferred until further investigation was completed. The additional investigation of air emissions and ground-water have been completed. Based on the results of previous studies, the additional investigation and the limited effectiveness of the clay cap repairs, the U.S. EPA has decided to implement the following remedial actions. The State of Illinois concurs with the selected remedy. The Record of Decision (ROD) can be amended if new data shows that it is necessary.

- Long term monitoring of ground water and Mutton Creek with action levels to reopen the ROD;

- Continued monitoring of the downgradient contaminant plume with action levels to reopen the ROD;

- Additional air emission control including new and additional vents and, if determined necessary, an active collection system with a ground flare or other appropriate treatment;

- Imposition of restrictions on usage of on-site ground water. The site is considered to be the property on which the landfill is located;

- Upgrade of the northern portion of the site cover to reduce infiltration, reduce surface gas emissions, control erosion due to run-off from the site and due to erosion from Mutton Creek.

- Continued operation of the leachate collection system;

- Long term inspection and maintenance of the gas venting and leachate collection systems, site cover, fence, and the monitoring well network.

DECLARATION

The selected remedy is protective of human health and the environment, attains Federal and State requirements that are applicable or relevant and appropriate, and is cost-effective. This remedy satisfies the preference for treatment that reduces toxicity, mobility or volume as a principal element. Finally, it is determined that this remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable for this site. The size of the landfill and the fact that there are no on-site hot spots that represent the major sources of contamination preclude a remedy in which contaminants

could be effectively excavated and treated. In-situ biodegradation will continue to be the principal method of treatment.

Because this remedy will result in hazardous substances remaining onsite above health-based levels, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

for Marcia M. Covington

Valdas V. Adamkus
Regional Administrator

3/31/89
Date

Attachments: (1) Summary of Remedial Alternative Selection
(2) Community Relations Responsiveness Summary

Summary of Remedial Alternative Selection at the Wauconda Sand and Gravel Site

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1.0 Location Description

The Wauconda Sand and Gravel site is located in Lake County, Illinois, north of the Village of Wauconda and three miles east of the Village of Island Lake. The 74-acre site is comprised of a 43-acre unpermitted landfill, a nine-acre permitted landfill, an additional nine acres which are excavated but unfilled, and 13 acres of perimeter site area. The nine acres at the southern part of the site were permitted by the IEPA as a sanitary landfill (Figure 1). This site is bordered on the east by Garland Road, on the south by Bonner Road, and on the west by pasture and cropland. Surface drainage from the site is predominantly to the north into Mutton Creek. Mutton Creek drains into Island Lake, which is approximately 3-1/2 miles west of the site.

Approximately 12 homes are located within one quarter mile north and east of the landfill perimeter. A new development called Valentine Lakes Estates is located farther northeast. A residential development of approximately 100 homes known as the Hillcrest community is located east of the site. These residences are on well water but 90 percent are outside the groundwater flow boundaries from the site in the shallow aquifer. The landfill itself is zoned within the municipal boundaries of the Village of Wauconda; the surrounding homes and Hillcrest community are not located within the city limits.

Southeast of the site is the Village of Wauconda. Village residents are mostly on a municipal water system although some private residential wells are in use. One of the municipal wells is located near Bonner Road approximately 1000 feet east of the site. This well is reportedly 1027 feet deep, in the bedrock beneath the lower aquifer. There are also a recycling center, auto reclaimer, and construction company and one residence located adjacent to the landfill along its eastern border.

1.1 Physiography

The Wauconda area is located in the Valparaiso Moraine System where the surface topography is composed of low ridges and hills interspersed with lakes and peat bogs in low elevation areas. The surface features are underlain by 100 to 200 feet of glacial till deposits of varying compositions and extent.

The site overlies two aquifers. A shallow aquifer, which is believed to have limited contamination, lies directly beneath the landfill and overlies an impermeable layer of glacial till. A deeper aquifer lies below the till layer. Bedrock underlies the lower aquifer at depths of 200 to 300 feet below the surface (Figure 2).

Based on the reported landfill depth, measured ground water elevations and ground surface contours, it has been determined that only a small percentage, if any, of the total landfill volume lies below the water table in the upper aquifer. All nearby residents are believed to have wells in

the lower aquifer and sampling results have not indicated an impact from the site on these wells.

Five stratigraphic units underlie the site. These are:

1) A Surficial Clayey Silt Unit;

2) An Upper Sand Unit (upper aquifer);

3) A Clay Unit (aquitard) (Its continuity is uncertain);

4) A Lower Sand Unit (lower aquifer); and

5) A Dolomitic Bedrock Unit.

The structure of these units at the site is shown in the southwest to northeast cross-section in Figure 2. It is uncertain whether the aquitard separating the upper and lower aquifers is continuous near the site. The two aquifers are known to be connected 1500 feet east of the site (Figure 3). Flow in the upper aquifer is to the north and northeast (Figure 4) while flow in the lower aquifer is to the southwest (Figure 5). It is predicted that an interconnection between the upper and lower aquifers exists 1000-1200 feet north or northeast (downgradient groundwater flow direction) from the site.

The volume of the landfill is estimated to be between 2.8-3.1 million cubic yards. In the northern part of the unpermitted landfill, wastes may be separated from the aquifer by a portion of the surficial clay silt unit and in the southern part wastes are above sandy material but are mostly above the water table. In the permitted landfill wastes were placed above the water table and a compacted clay liner installed on the bottom and sides.

1.2 Site History and Enforcement Activities

Prior to 1941 the Site was a sand and gravel operation. Between 1941 and 1977, before the State required landfills to be permitted, the northern three-quarters of the Site was used as a landfill. This portion of the Site is known as the unpermitted landfill. Waste disposal in the unpermitted section of the landfill generally commenced in the southern portion and progressed northerly. In June 1977, a nine-acre portion in the southern one-fourth of the Site was permitted for solid waste disposal (permitted landfill) by IEPA and was operated until July 1978 when the entire Site was closed and covered by a layer of clay and soil. During its operation, the landfill received municipal, residential, commercial and industrial wastes. Site activities have been monitored by the IEPA since the mid-1970s. The site property was subsequently used for recreational activities including rifle practice, model airplane flying and snowmobiling. Site access is currently restricted by a security fence.

Problems with leachate discharge to Mutton Creek as well as groundwater contamination were recorded in a July 10, 1974 report by Testing Engineers, Inc. In the 1974 report, as well as in sampling results from the

Illinois Environmental Protection Agency (IEPA) in 1975, levels of chloride, total dissolved solids, sodium and other parameters upstream and downstream in Mutton Creek indicated that the landfill was having a substantial effect on the water quality of Mutton Creek. In 1976, the operator took measures to control this leachate discharge under a "Compliance Agreement" with IEPA. In 1980, records show that IEPA inspectors observed leachate seepage into Mutton Creek. Also in 1980, IEPA detected PCB in one residential well, a number of monitoring wells and in surface water samples from the site. In 1981, the United States Environmental Protection Agency (U.S. EPA) received an anonymous report that 600,000 gallons of PCB had been disposed of at the site. Based primarily on the above preliminary assessment information, U.S. EPA determined a Hazardous Ranking System score for the site and in September 1983, it was placed on the National Priorities List, which made it eligible for investigation and remedial action under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) program.

In 1983, the U.S. EPA initiated a potentially responsible party (PRP) search and a remedial investigation (RI) for the Wauconda Sand and Gravel site. U.S. EPA identified fifteen PRPs, some of whom organized into a group called the Wauconda Task Group (WTG). The RI included ground water, air, leachate, surface water and surface sediment sampling. The first report on the remedial investigation was the Remedial Investigation Data Report August 29, 1984. This was followed by the Remedial Investigation Analysis/Development of Alternatives Report November 1, 1984.

No PCBs were detected in samples taken during the RI although metals and some organic compounds were identified as being at levels of concern. The WTG reviewed these reports and contended that data gaps and deficiencies existed in these reports. In response, both the U.S. EPA and the WTG conducted limited additional sampling. The results of the additional sampling by U.S. EPA are included in the Remedial Investigation Supplement, July 1985. The feasibility study (FS) was completed and included in the Public Comment Draft Feasibility Study, August 1, 1985. The WTG communicated a number of disagreements with these reports during the public comment period.

Record of Decision - 1985

Based on the foregoing studies and the public comments, U.S. EPA decided to implement a first operable unit in a Record of Decision (ROD) dated September 30, 1985. In this ROD, U.S. EPA concluded that a release of contaminants to Mutton Creek was occurring due to the high concentration of cadmium, zinc, lead, silver and chromium and cyanide in the leachate. It was concluded that the effect of the leachate discharge could not be measured but that it may have an adverse effect.

U.S. EPA also concluded that a release to the ground water was occurring. The low levels of contaminants detected and limited amount of data made quantification of the contaminants in the groundwater difficult at that time. It was concluded that additional ground water sampling and investigations were needed.

U.S. EPA determined that direct contact with leachate and close approach to the landfill vents by trespassers could have an adverse health effect, and to address that threat, that access to the site should be restricted.

The following remedial actions were specified to eliminate the discharge of leachate to Mutton Creek and restrict access to the leachate collection system and landfill vents:

- installation of a leachate collection system to intercept leachate drainage before it reaches Mutton Creek;
- provision for off-site leachate disposal;
- regrading of settled, depressed and eroded areas on the landfill cover with sufficient slope to reduce infiltration and promote rain run-off;
- revegetation of bare and ponded areas to prevent erosion of soils into Mutton Creek and exposure of landfill materials;
- construction of a fence around the site to protect the landfill cover and to prevent human contact with gas vents and leachate collection system.

Operable Unit No. 1 RD/RA

Following the ROD, U.S. EPA and IEPA began negotiations with the WTG for implementation of the operable unit and for conduct of a supplemental remedial investigation/feasibility study (RI/FS). U.S. EPA and IEPA reached an agreement with the WTG under which the WTG would (1) undertake Remedial Design and Remedial Action activities to implement the operable unit remedial actions and (2) undertake a supplemental RI/FS. The Consent Order for this first Remedial Design and Action (RD/RA) became effective on July 28, 1986. The WTG initiated the supplemental RI/FS in August 1986, submitted a draft report in August 1987, and a final report in November 1987. U.S. EPA and IEPA reviewed the final report and prepared an Amendment to it in April 1988. The November 1987 report from the WTG along with this amendment and the additional investigation report prepared by Metcalf and Eddy for U.S. EPA and dated Jan. 1989 constitutes the complete RI/FS for the purpose of this ROD.

The WTG completed installation of the fence, the leachate collection system pursuant to RD/RA Consent Order, and some of the site cover repairs by September 1, 1987. The WTG was to have completed the remainder of the site cover repairs during the summer of 1988.

There were leachate discharges to Mutton Creek from the Wauconda site during construction and during the fall of 1987 due to equipment failures. U.S. EPA has increased its inspections and outlined procedures to be followed to prevent future discharges to Mutton Creek.

According to the Consent Order signed June 8, 1986, WTG was responsible for leachate collection. On September 30, 1988 a second Consent Order was

signed with Browning and Ferris Industries to continue cap maintenance and leachate removal through May 31, 1989.

The U.S. Army Corps of Engineers (COE) reviewed the site and recommended erosion control and other maintenance tasks needed to reduce infiltration through the site cover.

In March 1988, U.S. EPA and IEPA ordered the WIG to conduct additional downgradient sampling. U.S. EPA conducted additional air sampling in May and October of 1988.

In May 1988, U.S. EPA sent special notice letters to the PRPs that had been identified. Modifications to the Proposed Plan caused postponement of the "good faith proposal" deadline. Revised special notice letters were sent December 16, 1988. The PRPs were required to submit a good faith proposal by February 20, 1989.

1.3 Nature and Extent of Contamination

In 1980, volatile organic compounds (VOCs) and polychlorinated biphenyls (PCBs) were detected in a private well near the eastern boundary of the landfill. Subsequent investigations conducted by IEPA and the Lake County Health Department detected PCBs, metals and VOCs in groundwater and surface water. The site was then placed on the National Priorities List (NPL) in 1983, making it eligible for a federally funded remedial action. PCBs have not been detected in any sampling conducted since U.S. EPA started its site investigations in 1983.

Groundwater:

Groundwater contamination at the Wauconda site has been limited to relatively low concentrations of contaminants. The selected remedy will further characterize groundwater quality via long term monitoring to ensure that existing measures are protective of human health and the environment. Natural attenuation via normal biodegradation of contamination is expected to occur. If monitoring well samples indicate that offsite groundwater contamination levels are above health-based risk assessment levels or do not meet ARARs, then the Agency will reopen the ROD and select an appropriate response action. Attachment A summarizes the ground water data and compares contaminant concentrations up- and downgradient of the site and in the leachate.

The data clearly shows that high COD, chloride, sodium and other water parameters exist in the upper aquifer downgradient from the site due to leachate from the landfill. Iron and zinc are also at elevated levels downgradient from the site. All these parameters are expected contaminants from sanitary landfills. Chloride concentrations are higher in some downgradient wells than in on-site wells. This indicates that the chloride plume may have already migrated past the existing monitoring well network.

Leachate:

The estimated total volume of the landfilled waste is 2.8-3.1 million cubic yards (compacted). A complete record of the contents of the wastes disposed of in the landfill does not exist. The documentation suggests that approximately 10% of the landfill volume was filled with wastes from industries. The available documentation on hazardous wastes (approximately 1 percent of the total landfill volume that were disposed of at the site) is summarized in Attachment B.

Thirteen leachate samples have been analyzed for a large range of inorganic and organic hazardous substances since U.S. EPA started investigating the site in 1983. The leachate from the site is high in chemical oxygen demand (COD), chlorides, ammonia, iron, calcium, magnesium, sodium and zinc. Other metals, phenolics, phthalates and a large number of volatile organic compounds (such as methylene chloride, acetone, 2-butanone) were also present at elevated concentrations in the leachate. Leachate concentrations are compared to constituents detected in ground water and surface water in Attachments C and D. Studies have shown that the highest contaminant concentrations in leachate from landfills normally occur early in the history of the landfill. Inasmuch as the last portion of the Wauconda Landfill was filled ten years ago, concentrations of leachate contaminants are not expected to increase.

Site Cover:

The thickness of the site cover was previously measured in 47 locations and 13 laboratory permeability tests were run on samples from the existing soil cover. The cap thickness is from 3.5 to 5 feet over most of the site. The cap is made up of clay or silty clay with a thin vegetative layer on top. The measured permeability of the cap soils was from $6x10^{-8}$ to $3x10^{-7}$ cm/sec. Using the measured permeability, it was estimated that the infiltration through the site cover could be as low as one inch per year averaged over the entire cover. However, the actual infiltration through the site cover is considerably greater than this estimate because of cracks present in the cover. Since a large portion of the landfill is underlain by sandy soil, there is a continuing release of hazardous substances in the leachate to the ground water.

Soil borings performed in 1988 shows numerous isolated areas of the landfill cover to have clay covers thicknesses of less than 3.5 feet, less than 2 feet and some less than one foot. Gas emissions have been observed in these areas and infiltration of water is contributing to the leachate production and migration to the groundwater.

Air Emissions:

Sampling data from 1988 indicate that no immediate action is required, but with cap improvements, models suggest that additional vents are needed to control methane migration to the perimeter of the site. If new monitoring data indicate that incremental carcinogenic risk to nearby residents is

greater than 10^{-6} lifetime exposure to airborne contaminants from the site, then it will be necessary to provide gas emission control systems.

Lateral migration and surface releases indicate that the existing vent system does not provide sufficient escape pathways for the expected quantity of methane and other gases produced in a landfill of this size.

Risk assessments by the EPA Air and Radiation Branch, and Metcalf and Eddy indicate that a number of properly installed additional vent pipes must be placed in the landfill and monitored. If analyses indicate that a risk still remains, an active collection system with ground level flares or other treatment will be implemented. This ROD will be reopened to incorporate such air emissions treatment systems.

1.4 Public Health Issues

As part of the Supplemental Remedial Investigation and Feasibility Study (SRI/FS), a risk assessment was conducted which utilized environmental data collected during the RI. The purpose of the risk assessment was to determine the present or future potential adverse effects of the Site on public health and the environment. The risk assessment identified three potential migration pathways for contamination from the Site. These pathways are surface water, groundwater, and air.

Surface Water Route

With respect to surface water, Mutton Creek is identified as the only point of direct contact. Mutton Creek flows into Island Lake, which is used for recreation and fishing. Since the late 1970s, leachate from seeps along the northern perimeter of the Site has entered Mutton Creek. Trace levels of volatile organic compounds (VOCs) were detected in surface water and sediment samples collected downstream of the landfill. The concentrations of these VOCs in surface water were slightly higher in downstream samples than in samples collected immediately upstream of the site. Each VOC detected was below the drinking water standards for that substance. The Proposed Plan calls for continued monitoring of surface water for VOCs and other parameters. Failure of the Site leachate collection system and/or site cap would be detected by this sampling.

Pesticides were not detected in any surface water samples except those collected directly downstream of a farm field drainage ditch which is immediately downstream of the landfill. These may have been present due to agricultural usage in the area since no pesticides were found in landfill leachate. It does not appear that the site is the source of pesticides in Mutton Creek.

Low levels of Base/Neutral/Acid extractable compounds (BNAs) were found in surface water samples collected immediately upstream and downstream of the landfill. Similar trace levels of BNAs were found in sediment samples adjacent to and upstream of the landfill.

Metals such as iron, potassium and sodium were detected downstream at higher levels in Mutton Creek surface water, than upstream. PCBs were not detected in any surface water, sediment or landfill leachate samples during this study. Dioxin was not detected in the sediment samples analyzed for this compound.

The 1985 ROD, concluded that the leachate exceeded the Ambient Water Quality Criteria (AWQC) for protection of fresh water aquatic life for the following parameters: cadmium, zinc, lead, silver, chromium, and cyanide. These parameters also exceeded AWQC in some of the leachate samples collected for SRI/FS and subsequent sampling.

The AWQC for ammonia, copper, arsenic and iron were exceeded in some leachate samples and the State of Illinois General Use Standards were exceeded for copper, iron, silver, zinc, phenols, boron, manganese, chloride, sulfate and total dissolved solids. However, the AWQC for iron and lead and the Illinois General Use Standard for iron were also exceeded in some upstream samples from Mutton Creek.

The State of Illinois Cleanup Objectives Team has recommended that any leachate discharge to Mutton Creek should meet drinking water standards. Many of the VOCs and metals in the leachate exceed drinking water standards.

It was concluded that the leachate discharge had a negative impact on aquatic life in Mutton Creek especially during low flow periods in the Creek. Since no accumulation of metals or arsenic was detected in downstream sediments, there is no indication of any long term affect on the water quality or biota.

Groundwater Route

Currently, there is no completed pathway for human exposure to contaminated groundwater. However, groundwater from the upper aquifer will eventually migrate to the lower aquifer. In addition, a drinking water well may be developed in the upper aquifer in the future. Since the upper aquifer does not discharge to surface water, there is no potential impact on other aspects of the environment including air, soil and aquatic life.

Some general water quality parameters such as chloride, sodium, and total dissolved solids form a plume in the upper aquifer downgradient from the site. These parameters are considered normal contaminants from sanitary landfills and are not considered toxic.

The residential well data showed no contamination of human health concern according to ATSDR. Available information indicates that the active residential wells are screened in the lower sand aquifer or a bedrock aquifer.

Two modes of exposure exist for the future:

1. Installation of a new residential well within a potential landfill plume in the lower aquifer;

2. Migration of contaminants in the plume to downgradient residential wells in the lower aquifer.

In order for contaminants to affect downgradient residential wells in the lower aquifer, the constituents must first migrate through the upper aquifer. Therefore, if the risks are acceptable in the shallow aquifer, the downgradient lower aquifer will also be protected.

The selected indicator chemicals for the ground water risk assessment are: arsenic; lead; nickel; benzene; tetrachloroethene; vinyl chloride; and n-nitrous-diphenylamine. The procedures used to evaluate the risk to human health for each indicator chemical were compared with the U.S. EPA Maximum Contaminant Limits (MCLs), or, if MCLs were not available, to the 10^{-6} carcinogenic risk level for lifetime drinking water usage calculated using U.S. EPA potency factors. Other EPA guidance values were also used.

The cumulative carcinogenic and non-carcinogenic risks were also calculated for the indicator parameters, and all liver carcinogens and liver toxicants. The results are shown in Attachment E. The results show that average concentrations for arsenic, lead, vinyl chloride and benzene, exceeded the MCLs in some on-site monitoring wells. The average risk levels for tetrachloroethene and n-nitrous-diphenylamine exceeded the 10^{-6} risk level in some on-site monitoring wells.

In off-site monitoring wells, none of the averages exceed the MCLs except for lead in well G203A. Well G203A is a former residential well that is now being used as a monitoring well. The very high lead concentrations in this well are inconsistent with lead concentrations in nearby wells. Therefore, it is believed that the lead detected in G203A is a contaminant from the well construction.

The vinyl chloride averages are essentially equal to the MCL in two off-site monitoring wells, and the benzene average is near the MCL in one off-site well. During round 7 of sampling, the vinyl chloride concentration in well OW403 was 2.8 ug/l, which is above the MCL of 2 ug/l.

The 10^{-6} risk level was exceeded by arsenic, tetrachloroethene, vinyl chloride and benzene in some off-site monitoring wells. The risk levels in off-site monitoring wells were as high as $5x10^{-4}$ for arsenic, $2x10^{-6}$ for tetrachloroethylene, $1x10^{-4}$ for vinyl chloride and $4x10^{-6}$ for benzene. For arsenic, vinyl chloride and benzene the MCLs are established above the 10^{-6} risk level and as a result, the average concentrations for these compounds do not exceed the MCLs. Tetrachloroethene was detected during round 6, in one off-site, downgradient sample at 1.8 ug/l which makes the average above the 10^{-6} risk level. However, during round 6, tetrachloroethene was detected at similar concentrations in three residential wells outside the influence of the landfill. The ATSDR reviewed the residential well data and

determined that the tetrachloroethene detected in the residential wells did not indicate an unacceptable human health threat. Tetrachloroethene was not detected any more frequently in monitoring wells downgradient from the site than in upgradient or crossgradient or lower aquifer wells.

The cumulative carcinogenic risk levels were then calculated. Based on these calculations, it was determined that arsenic and vinyl chloride were the compounds of primary concern for carcinogenic risk. The calculated risk levels for vinyl chloride were small compared to those for arsenic even though arsenic was well below its MCL in off-site ground water (30 ug/l was the highest concentration in any off-site ground water sample).

In one lower aquifer monitoring well, trichloroethene was detected during the last three rounds of samplings. Tetrachloroethylene was also detected in three samples but was at or below the 10^{-6} carcinogenic risk level. The concentration was above the MCL in one sample. There is a possibility that the lower aquifer could be affected by the plume from the site because of uncertainty in the continuity of the aquitard. Benzene was detected near the MCL in one out of two sampling rounds. Trichloroethene was detected near its MCL in one out of two sampling rounds. Trichloroethene was detected near its MCL in one out of three sampling rounds and n-nitrosodiphenylamine was detected at above the 10^{-6} carcinogenic risk level in one out of two sampling rounds.

In conclusion, the on-site monitoring well data indicates that usage of ground water from the upper aquifer below the site property presents an unacceptable health risk to future development. Off-site ground water in the upper aquifer near the site does not exceed concentrations considered acceptable for drinking water usage.

A plume of chlorides, total dissolved solids, COD and other constituents that are typical of sanitary landfills is migrating from the site to the north and northeast. The plume is expected to reach 1200 feet downgradient from the site, which is significantly past the existing monitoring well network. The ground water in a large portion of the plume is probably unpalatable. Concentrations of chlorides and total dissolved solids exceed secondary MCLs in large portions of the plume off the site. Sodium is present at concentrations that may be of concern to persons on a low sodium diet.

The continuity of the aquitard does not extend to the east sufficiently to fully protect the lower aquifer. Therefore, it is possible that contaminants could migrate to the lower aquifer, and affect the residential wells in the lower aquifer. If infiltration from above is limited, the low concentration of contaminants detected in the lower aquifer monitoring wells will be attenuated by dilution and biological decomposition.

Air Route

Nearby residences are considered potential exposure points for contamination emanating from the landfill in the form of gases and vapors. A "walk through" air quality survey identified elevated levels of organic vapors

near gas vents and cracks in the soil cover on site. The U.S. EPA determined that the compound-specific air emissions data from the RI (Remedial Investigation Data Report, 1984) are unreliable due to quality assurance problems. The proposed remedy addresses the need for additional remediation of air emissions from the landfill. Further testing in May 1988 indicates a carcinogenic health risk of 10^{-6}, according to air models. The proposed remedy addresses the need for additional remediation of air emissions from the landfill.

The U.S. EPA Region V recommends that more gas vents and, if required, a gas control system be installed on the landfill for the following reasons.

Total peak risk offsite ranges from 10^{-7} to greater than 10^{-6}, depending on the emission scenario. Given the uncertainties in gas vent flow rates, the emission rates from the landfill cap, the possibility that with the installation of a better grade cap, the landfill gas will be forced to flow laterally, and the proximity of residential housing to the landfill, U.S. EPA believes that the installation of a gas treatment system, either flaring or carbon adsorption, is an appropriate conservative measure for this site if these projected potential gas emission rates are achieved.

The very high levels of methane (as high as greater than 800% of the Lower Explosive Limit) present a safety hazard on site. If the methane gas migrates offsite and enters basements of nearby homes, a public health hazard will develop.

Although U.S. EPA does not currently regulate landfill emissions, work has commenced to propose regulation in the future. A preliminary background document on municipal solid waste landfills notes that the estimated efficiency for destruction of methane through flaring or capture through adsorption is 98%, and the ARB expects that guidelines will require some or all municipal landfills to meet this destruction efficiency. If such regulations are finalized, they will become Applicable or Relevant and Appropriate for the Wauconda site in order to ensure public health, safety and welfare.

1.5 Community Relations

For the first operable unit, a public comment period was held from August 12-30, 1985 and a public meeting was held on August 14, 1985.

The public comment period for the second operable unit proposed remedy was conducted from May 2-May 25, 1988 and a public meeting was held on May 11, 1988. The SRI/FS, Proposed Plan and the Administrative Record were made available at the Wauconda Public Library prior to initiation of the public comment period. The comments received during the public comment period are included in the Responsiveness Summary.

Other public meetings were held on December 8, and December 14, 1988 to discuss the questions brought up in the May 11, 1988 meeting and the results of subsequent air emissions testing.

2.0 Alternative Technologies for Remedial Action

A set of remedial alternatives were evaluated in the SRI/FS report, to address contamination at the Wauconda Sand and Gravel site. Initially, fifteen alternatives were subjected to a preliminary screening for implementability, effectiveness and cost.

- Excavation
- Emission control
- Solids/semi solids treatment
- Liquids treatment
- In situ treatment
- Solids disposal (untreated wastes)
- Capping
- Vertical containment barriers
- Horizontal containment barriers
- Ground water pumping
- Subsurface drains
- Liquids disposal (untreated wastes)
- Gas collection systems
- Alternative water supply
- Incineration

The response actions selected in this Record of Decision are measures designed to complement the first operable unit partial remedy. Continued leachate collection and additional improvements to the site cap will reduce releases of contaminants from the landfill to the surrounding environment. Four of these alternatives were selected for further analysis.

ALTERNATIVE 1: NO ACTION (Statutory Requirement)

Alternative 1 requires no further action beyond a one-year maintenance period on the interim remedial measures (IRMs) implemented under the June 8, 1986 Consent Order. No additional remedy will be executed under this alternative. No monitoring would be conducted to measure potential changes in surface water and ground water quality.

ALTERNATIVE 2: LONG TERM MONITORING WITH ACTION LEVELS TO REOPEN ROD; FURTHER UPGRADE OF THE SITE CAP; CONTINUED OPERATION AND MAINTENANCE OF THE SITE CAP, FENCE AND LEACHATE COLLECTION SYSTEM; USE RESTRICTIONS ON THE SHALLOW AQUIFER BELOW THE SITE; AND ADDITIONAL INVESTIGATION (U.S. EPA and IEPA Recommended Alternative)

The long-term monitoring with action levels (generally equal to drinking water standards or health based criteria) to reopen the ROD will provide protection for ground water users. The 30 year long-term monitoring program will include annual sampling of Mutton Creek and 11 monitoring wells, and quarterly sampling of six monitoring wells. If it is determined that hazardous substances are present above relevant action levels, and that they originated from the site, alternatives for additional remedial action will be evaluated. Continued operation and maintenance of the leachate collection system will assure that leachate discharge to Mutton Creek does

not occur. Further upgrading and maintenance of the site cap is needed to prevent erosion and to reduce infiltration into the landfill from precipitation. Maintaining the site fence will prevent damage to the site cap from unauthorized use of the property. Use restrictions on the shallow aquifer immediately below the site will prevent human consumption of ground water containing hazardous substances above drinking water standards.

During the first year of remedial action, U.S. EPA and IEPA are recommending additional ground water and air emissions monitoring. Part of the monitoring would include installation and monitoring of two to four additional downgradient wells in the upper aquifer to the north and northeast of the Site. The wells would be placed near the leading edge of the contaminated plume because the contaminant plume may have migrated beyond the existing monitoring well network. Additional sampling of wells in the deep aquifer, near where contaminants have been detected, is also recommended. Additional air emissions data will be used to evaluate any risk from additional vents. If this investigation identifies an unacceptable risk, remedial alternatives, such as an active venting and ground flare system will be evaluated. Radon concentration levels must also be considered in this evaluation.

ALTERNATIVE 3: GROUND WATER PUMPING AND TREATMENT:

This alternative would provide a ground water pumping system designed to contain liquids from the landfill. It is estimated to require several pumping wells that together would remove 200 gpm from the ground water. A treatment system for the water would be needed that would include metals precipitation, and possibly VOC removal and salinity reduction. The repaired cap, fence and leachate collection system also would be maintained beyond the original Consent Order period. Following treatment, water would be discharged to Mutton Creek, which would require subsequent monitoring. Ground water monitoring and leachate collection system operation is identical to that in Alternative 2.

ALTERNATIVE 4: SYNTHETIC LINER CAP

This alternative involves adding a new synthetic liner cap over the existing clay cap, as well as operating and maintaining the leachate collection system, for the length of the Consent Order period. The cap and fence would be maintained for 30 years. The basic monitoring system would also be implemented under this alternative. About 20,000 cubic yards of refuse would require excavation and relocation in steeply sloped areas to enable placement of the synthetic liner. An improved gas collection and venting system would be required as part of this alternative.

OTHER ALTERNATIVES

Excavation and off-site disposal, and excavation and on-site incineration were evaluated and screened out. Excavation and off-site disposal includes excavation of all waste materials in the landfill and redisposal in another landfill designed pursuant to regulations for hazardous waste landfills.

Excavation and on-site incineration includes excavation of all waste materials and on-site incineration of those materials. A synthetic liner cap and groundwater pumping combination of Alternatives 3 and 4, including monitoring and maintenance as described, would provide an alternative that would be available if the chosen alternative proves ineffective as measured by future monitoring.

The narrowed list of alternatives concentrate on source containment alternatives. Source treatment alternatives such as solidification and incineration were screened out because of the excessive cost of treating 3 million cubic yards of waste, the risks involved in excavation, and other implementation problems.

2.1 Evaluation Criteria

EVALUATION CRITERIA FOR THE RECOMMENDED ALTERNATIVE

In selecting the remedial alternative to be implemented at the Wauconda Sand and Gravel Site, U.S. EPA will consider the following nine criteria:

1. Overall Protection of Human Health and the Environment addresses whether or not a remedy provides adequate protection, and describes how risks are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

2. Compliance with ARARs addresses whether or not a remedy will meet all of the applicable or relevant and appropriate technical standards (ARARs) of other environmental statutes and/or provide grounds for invoking a waiver.

3. Long-term Effectiveness and Permanence refers to the ability of a remedy to maintain reliable protection of human health and the environment over time, once remedial goals have been met.

4. Reduction of Toxicity, Mobility, or Volume is the anticipated performance of the treatment technologies a remedy may employ.

5. Short-term Effectiveness involves the period of time needed to achieve protection from any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

6. Implementability is the technical and administrative feasibility of a remedy, including the availability of goods and services needed to implement the chosen solution.

7. Cost includes capital and operation and maintenance costs.

8. Support Agency Acceptance indicates whether, based on its review of the RI/FS and Proposed Plan, the support agency (IEPA) concurs, opposes, or has no comment on the preferred alternative.

9. Community Acceptance is assessed following a review of the public comments received on the FS Report and the Proposed Plan.

The recommended remedy, which contains provisions for the evaluation of remedial actions in case ground water near the site exceeds drinking water standards, will be fully protective of public health and the environment; and, at the same time, will be cost effective. If a ground water pump and treatment system were installed, during its period of operation it would recover any contaminated ground water from the site, and would remove some existing ground water contamination. Contamination above drinking water standards is normally used as an action level for pumping and treatment. Monitoring wells off the site indicate that levels are currently at or below relevant drinking water standards.

Another alternative such as installation of a multi-layered site cap may further reduce infiltration compared to the existing cap, but would not be as cost effective.

Each of the above nine criteria are discussed for the recommended alternative.

The U.S. EPA and the Illinois EPA reviewed, respectively, Federal and State laws, standards, requirements, criteria and limitations for possible application to the site. The major ARARs identified are summarized below.

2.2 Applicable or Relevant and Appropriate Requirements

OFF-SITE GROUND WATER QUALITY (chemical specific): The following standards are relevant and appropriate:

Primary Maximum Contaminants Levels (40 CFR 141)
Public and Food Processing Standards
(35 Il. Adm. Code 302,304 health based only).

The Federal and State drinking water regulations provide for the establishment of drinking water standards for public water systems. These standards are applicable only to public water systems as defined by the regulations. However, they may be considered relevant and appropriate to attain for groundwater that can potentially be used for drinking. The shallow aquifer upgradient of the site is used as a drinking water source in the area of the site. The deeper aquifer is currently being used as a drinking water source and is connected to the shallow aquifer 1500 feet east of the site. Therefore, the Primary Maximum Contaminant Levels (MCLs) and the Illinois Public and Food Processing Standards (IPFPS) are considered ARARs for off-site groundwater quality.

SITE CLOSURE AND POST CLOSURE REQUIREMENTS (action specific):

There are two statutory schemes under the Resource Conservation and Recovery Act (RCRA) that may be relevant and appropriate to remedial decisions involving landfills. Both are considered to be protective of the public health and environment for the activities they regulate. Subtitle D of RCRA regulates landfills used after 1980 for disposal of non-hazardous solid wastes such as household wastes and construction debris. These are primarily implemented by the State of Illinois and are included in 35 Il. Adm Code 807. Subtitle C of RCRA regulates landfills used for disposal of hazardous wastes.

The available records indicate that the Wauconda Sand and Gravel Site was primarily used for disposal of non-hazardous solid wastes prior to 1980. U.S. EPA has conducted a thorough search for information on disposal at the Site. This information is incomplete. Of the 3 million cubic yard volume of the Site, only an estimated 1 percent of the total landfill volume has any documentation indicating it was a hazardous waste (Attachment B).

RCRA Subtitle C technical standards are relevant to this Site because the leachate, designated as "special waste", contains elevated levels of hazardous constituents. It is considered relevant and appropriate to consider Subtitle C closure performance standards.

The 35 Il. Adm. Code 807 includes the following closure requirements that are relevant and appropriate for this site:

807.502 (a): Closure must minimize the need for future maintenance,

807.502 (b): Closure must control, minimize, or eliminate release of waste, waste constituents, leachate, contaminants or waste decomposition products to the ground water, or the atmosphere, to the extent necessary to prevent threats to human health or the environment.

807.305 (c): Final cover of a compacted layer of not less than two feet of suitable material must be placed over the entire site.

The RCRA subtitle C requirements listed below are considered relevant and appropriate at this site:

40 CFR Section 264.310(b): Post-closure care after final closure of landfills includes maintenance of the integrity and effectiveness of the final cover. This includes repairing the cap, as necessary, to correct the effects of settling, subsidence, erosion, etc. It is intended that the leachate collection and removal system will be operated until leachate is no longer detected. The ground water monitoring system must be maintained and monitored. Run-on and run-off must be prevented from eroding or damaging the final cover. Benchmarks which are used to map the location of the landfill must be protected and maintained.

40 CFR Section 264.14: The active portion of the site must be protected from entry by unauthorized or unknowing persons and livestock, unless it has been demonstrated that physical contact or disturbance of the waste structures or equipment will not cause injury. (Closure activities are part of the active life or active portion of the site.)

40 CFR Section 264.117 (a), (b) and (c): The security requirements of Section 264.14 may be continued during the post-closure care period. The post-closure use of the property must not disturb the integrity of the final cover, liner(s), any components of the containment system, or the function of the monitoring systems. The Regional Administrator, or in this case the Illinois State Director (Illinois is authorized for portions of the RCRA program) may allow post-closure use of the property if it will not increase the potential hazard to human health or the environment, or it is necessary to reduce such a threat.

40 CFR Section 264.116: When hazardous waste remains after closure, (i.e., surface impoundment, landfill, waste pile) a survey plat indicating the location and dimensions of the disposal area(s) must be submitted to the local zoning authority or authority with jurisdiction over local zoning

authority or authority with jurisdiction over local land use, and the Regional Administrator (IL Director). The plat must contain a note which states the owner's obligation to restrict disturbance of the hazardous waste disposal unit.

40 CFR Section 264.119: Record, in accordance with State law, a notation on the deed to the facility property - or on some other instrument which is normally examined during title search - that will in perpetuity notify any potential purchaser of the property that the land has been used to manage hazardous wastes.

LEACHATE COLLECTION SYSTEM (action specific): As the leachate contains hazardous compounds, the following RCRA Subtitle C requirements are considered relevant and appropriate:

40 CFR 264.15: General Inspection Requirements;
264.51, 264.52, 264.56: Contingency Plan;
264.192: Design and installation of new tank systems or components;
264.193: Contaminant and detection of release;
264.194: General operating requirements;
264.195: Inspections.

35 Il. Adm. Code 807.502(b): Closure must control, minimize or eliminate release of leachate to surface waters to the extent necessary to prevent threats to human health or the environment.

OFF-SITE TRANSPORTATION/TREATMENT/DISPOSAL OF LEACHATE (chemical and action specific): The State of Illinois determined that the leachate is not a hazardous waste but is a "special" waste. Therefore, it must be transported pursuant to 35 IL Adm. Code 809.

Off-site treatment must comply with the pretreatment standards pursuant to 40 CFR 403 and Sewer Discharge Criteria, 35 Il. Adm. Code 307. Hazardous waste transportation/treatment/disposal regulations in 40 CFR 260-264 are not applicable because the leachate does not meet the definition for a hazardous waste. They may be relevant and appropriate. RCRA regulations for non-hazardous transport are applicable.

TREATMENT OF LEACHATE OR GROUND WATER ON-SITE AND DISCHARGE TO MUTTON CREEK (chemical and action specific):

The following regulations are applicable:

State of Illinois General Effluent Standards, 35 Il. Adm. Code 403;

State of Illinois General Use Standards, Mixing Zone, Nondegradation, 35 Il. Adm. Code 302;

Monitoring and Reporting 35 Il. Adm. Code 305;

Performance Criteria 35 Il. Adm. Code 306;

NPDES permit requirements, 35 Il. Adm. Code 309.141, 309.142 309.143, 309.144, 309.152.

The following is relevant and appropriate:

U.S. EPA Ambient Water Quality Criteria for fresh water aquatic life. RCRA Subtitle C regulations are not relevant and appropriate because of the low concentrations of hazardous substances present in the ground water, and because the leachate does not meet the definition of a hazardous waste.

DISCHARGE OF GROUND WATER TO A PUBLICLY OWNED TREATMENT WORKS (chemical and action specific):

The following regulations are applicable:

Pretreatment Standards, 40 CFR 403;

Sewer Discharge Criteria, 35 IL. Adm. Code 809.

OFFSITE TRANSPORT AND DISPOSAL OF RESIDUALS FROM TREATMENT OF GROUND WATER OR LEACHATE (action specific):

RCRA Subtitle C requirements will be applicable if the residuals meet the definition for a hazardous waste under RCRA (40 CFR 261). Otherwise, the residuals will be an Illinois Special Waste and must be transported in compliance with 35 Il. Adm. Code 807. The residuals must be disposed of in a properly permitted facility under RCRA for hazardous wastes or under 35 Il. Adm. Code for special wastes.

AIR EMISSIONS FROM LANDFILL, OR POLLUTION CONTROL DEVICE CHEMICAL SPECIFIC: The following requirements are applicable:

35 Il. Adm. Code 201.141, Prohibition of Air Pollution: emission can not prevent attainment of ambient air standards.

The following requirements are relevant and appropriate:

35 IL. Adm. Code 807.502(b): Closure must control, minimize or eliminate release .... to .. the atmosphere, to the extent necessary to prevent threats to human health or the environment.

40 CFR 61, Subpart F: National emission standard for vinyl chloride.

WORK AFFECTING BANK OR CHANNEL OF MUTTON CREEK (ACTION SPECIFIC):

Illinois Revised Statute, Chapter 19, Section 65.G.

SAFETY PROCEDURES:

The following regulations are applicable: 29 CFR 1926/1910.

WELL CLOSURE:

The following regulation is applicable:

Il. Adm Code, Title 77, Chapter I, Subchapter r, Section 920, 120.

TABLE 1.0

Law or Regulation	Reference	Potential Remedial Requirements	Potential Operational Requirements
FEDERAL			
1. CERCLA/SARA	42USC 9601 et. seq.	Applicable, relevant and appropriate requirements under Section 121 of SARA	Applicable, relevant and appropriate requirements of 40 CFR 300.68 (NCP)
2. RCRA		Applicable to any waste or leachate disposal that meets definition of a hazardous waste pursuant to RCRA	Since hazardous substances are present, it may be appropriate to impose relevant RCRA operational requirements
3. Federal Manifest for Transport of Hazardous Waste	RCRA Section 3002(5), 40 CFR 262	Applicable to any waste or leachate disposal that meets definition of a hazardous waste pursuant to RCRA	Alternatives involving transport of hazardous substances
4. Federal Manifest for Transport of Non-Hazardous Wastes		Applicable to offsite transport	Alternatives involving transport of non-hazardous substances.
5. Permit for Structure of Work in or Affecting Navigable Waters (Section 10 of Rivers and Harbors Act)	33 CFR Part 320	N/A	Alternatives involving Mutton Creek
6. Response in a Floodplain or Wetlands	40 CFR Part 6, Appendix A	N/A	Alternatives involving Mutton Creek

TABLE 1.1

Law or Regulation	Reference	Potential Remedial Requirements	Potential Operational Requirements
FEDERAL			
7. Clean Air Act - National Air Quality Standards	40 CFR Part 52-62	N/A, Applicable to Industrial sources	Alternatives involving discharge to air including particulate matter less than 10 microns in size
8. Safe Drinking Water Act	40 CFR 141, 143	Regulates drinking water supplies using MCLs	Alternatives which involve drinking water as an end use
9. Intergovernmental Review Act		Alternatives requiring Federal funds, state funds or a cooperative agreement between State and Federal Agencies.	
10. Relocation Assistance and Property Acquisitions	Uniform Relocation Assistance and Real Acquisition Policies Act of 1979, 40 CFR 4	N/A	Alternatives involving property acquisition
11. Worker Safety and Health Protection	Occupational Safety and Health Administration (OSHA)	N/A	Worker Safety during Remedial Construction
12. Clean Water Act	CWA Section 402, 40 CFR 122, 125 Subchapter N	National Pollutant Discharge Elimination System (NPDES Permit)	Alternatives involving discharge to Mutton Creek (administered by the State)

TABLE 1.2

Law or Regulation	Reference	Potential Remedial Requirements	Potential Operational Requirements
FEDERAL			
13. Dredge or Fill Permit	CWA Section 404	N/A	Alternatives involving filling or dredging of Mutton Creek
14. Effluent Guidelines and Standards	40 CFR 400 Subchapter N, FWPCA	N/A	Alternatives involving discharge to publicly owned treatment works (POTW)
15. Federal Standards for Toxic Pollutant Effluent	40 CFR 129	N/A	Alternatives involving discharge to Mutton Creek (regulated by the State NPDES permit)
16. Hazardous Materials Regulations	49 CFR 170 to 179	N/A	Alternatives involving transport of hazardous materials
17. Conservation of Wildlife Resources	Fish and Wildlife Coordination Act	N/A	Alternatives involving Mutton Creek

TABLE 1.3

Law or Regulation	Reference	Potential Remedial Requirements	Potential Operational Requirements
STATE			
18. Illinois Water Pollution Control Rules	Illinois Environmental Protection Act	Applicable to Selected Constituents (see Table 3.2 and 3.3)	N/A
19. Illinois Solid Waste Regulations	Illinois Environmental Protection Act	N/A	Some requirement relevant and appropriate
20. Illinois Hazardous Waste Management Regulations	Illinois Environmental Protection Act	N/A	Alternatives with off site transport of hazardous waste
21. State NPDES Regulations	Illinois Environmental Protection Act and Clean Water Act	N/A	Alternatives involving discharge to Mutton Creek
22. State Air Pollution Regulations	Illinois Environmental Protection Act	N/A	Alternatives involving discharge to air

TABLE 1.4

Law or Regulation	Reference	Potential Remedial Requirements	Potential Operational Requirements
County			
23. Soil Erosion Control Permit	County Ordinance	N/A	Alternatives involving excavation or construction on unincorporated land (county land)
24. Conditional Use Permit	County Ordinance	N/A	Alternatives involving filling activities in the floodplain of Mutton Creek
25. Erosion Control Permit	Village Ordinance	N/A	Alternatives involving earth moving over 500CY (or at the discretion of the village building inspector)
26. Public Works Review	Village Ordinance	N/A	Alternatives judged by the Village to involve public health

3.0 Selection of Recommended Program

The evaluation of alternatives is summarized in the following table and discussion.

Alternative 1, the no action alternative, is unacceptable because it will result in resumption of the leachate discharge to Mutton Creek, increased leachate release to ground water, and increased risk of direct contact.

Alternatives 2-4 are all protective of the public health and the environment and meet ARARs. Because off-site ground water is not expected to exceed health based levels, Alternative 3 will not be recommended at this time. However, if monitoring shows such exceedances this alternative may become necessary.

Alternative 3, ground water pumping and treatment, would limit migration of hazardous substances in the aquifer. Treatment of VOCs for the pumping and treatment alternative is not needed at this time since the levels of VOCs in ground water are below the drinking water standards. If ground water is treated, VOCs in the ground water would be discharged via an air stripper or control device as required if the risk to off-site residents exceeds 10^{-6} for a lifetime. For the pump and treat alternative, some metals such as iron, copper and zinc, which are generally not harmful in ground water, would have to be removed prior to discharge to Mutton Creek to protect aquatic life. Salinity may also have to be determined and adjusted prior to discharge to Mutton Creek in order to protect aquatic life and meet State of Illinois discharge requirements.

Alternative 4 (synthetic liner) would significantly reduce infiltration and erosion potential compared to Alternative 2. However, the repaired and upgraded cover in Alternate 2 substantially reduces the amount of infiltration, and erosion can be controlled by upgrading and maintenance of the site cover. The installation of a synthetic liner cap is expected to cost approximately $12,000,000. Because the percentage of hazardous wastes in the site is small,upgrading and maintenance of the existing site cover along with action levels to initiate an appropriate remedial action will be protective of the public health. Alternative 2 (cap upgrade) is therefore the cost effective alternative for this site.

Therefore, the U.S. EPA has selected Alternative 2 to control hazards at the **Wauconda** Sand and Gravel site.

The following is a further description of how Alternative 2 meets each of the nine evaluation criteria.

1. Overall Protection of Human Health and the Environment

The continued operation and maintenance of the leachate collection system, upgrading and maintenance of the site cap and fence, along with a long-term monitoring program, with action levels for additional appropriate remedial action and use restrictions for on-site ground water, will protect current

and future ground water users. Although hazardous substances are being released to the ground water in the upper aquifer, the levels of these substances are at or below drinking water standards in off-site wells near the site perimeter. The levels of volatile organic compounds (VOCs) such as vinyl chloride, will be monitored using quarterly sampling data. The closest existing residential wells are hydraulically distant from the site over (1000 ft.). In the event that concentrations of hazardous substances in the ground water near the site increase above action levels, there will be ample time to select and implement a ground water remedial action before residential wells are affected, since the estimated average ground water flow rate is 30 feet per year.

The four additional monitoring wells proposed for installation in the upper aquifer downgradient of the Site, near the expected leading edge of the plume, will provide additional protection to well users by monitoring the portion of the plume that may have already migrated past the existing monitoring well network. These wells and an additional deep monitoring well in the lower aquifer on the west side of the site will also help confirm that the lower aquifer has not been impacted by the Site and help confirm the continuity of the aquitard.

The concentrations of vinyl chloride, lead, arsenic and benzene exceed drinking water standards in monitoring wells located on the Site property. Therefore, use restrictions are required for the shallow aquifer below the site. Continued operation of the leachate collection system should eliminate discharge of leachate to Mutton Creek. If the proposed air emissions sampling results indicate an unacceptable health impact on nearby residents, then air emission controls will be evaluated. Site cap upgrade and maintenance and the installation of an active venting system and flares (or treatment) will protect off-site home owners and commercial residents from exposure to toxic substances being emitted with the landfill gases.

No other alternatives would be significantly more protective of human health and the environment and as cost effective as the cap upgrading, maintenance and long-term monitoring alternative. Although one off-site ground water sample had vinyl chloride above the MCL during the last round of sampling, this does not justify the immediate implementation of the ground water pump and treat option, as the MCL was exceeded only marginally and previous results were below the MCL. The synthetic liner cap alternative would further reduce the risk of release to ground water by reducing infiltration. However, past releases have not exceeded drinking water standards, and releases appear to have moderated and are expected to decrease over time due to the repairs to the existing site cover, and the removal of volatile organics by the improved venting system.

2. Compliance with ARARs

SARA requires that remedial actions meets legally applicable or relevant and appropriate requirements of other environmental laws. These laws may include: the Toxic Substances Control Act, the Safe Drinking Water Act, the Clean Air Act, the Clean Water Act, the Solid Waste Disposal Act (RCRA), and

any state law which has stricter requirements than the corresponding federal law.

A "legally applicable" requirement is one which would legally apply to the response action if that action were not taken pursuant to §104 or §106 if CERCLA. A "relevant and appropriate" requirement is one that, while not "applicable" is designed to apply to problems sufficiently similar that their application is appropriate.

The following is a description of environmental laws which are legally applicable or relevant and appropriate to different components of the remedy, and an explanation of how this remedial action meets those requirements.

Drinking Water Standards: Ground water near the site meets drinking water standards for hazardous substances. The level of vinyl chloride will be better defined during the first year of quarterly sampling and analysis. Relevant drinking water standards are the State of Illinois standards listed in Table 3.3 of the FS, and the National Primary Drinking Water Standards, found at 40 CFR 141.

Solid Waste Landfill Closure Requirements: The landfill cover will consist of a compacted layer of two feet or more of low permeability soil plus a cover of one foot of soil to support vegetation with an average thickness of four feet. This meets or exceeds the State of Illinois cover requirement of two feet of suitable material for closure of sanitary landfill (35 Ill. Adm. Code 807.305). This existing cover also satisfies the State requirement to control, minimize or eliminate the release of waste, waste constituents, leachate, contaminated rainfall, or waste decomposition products to the ground water, surface waters or the atmosphere, to the extent necessary to prevent threats to human health or the environment (807.502 (b)) and to minimize the need for future maintenance (807.502 (a)). RCRA Subtitle C is relevant and appropriate and is satisfied by the landfill cover on the basis of performance standards described.

Neither the sanitary landfill requirements of Subtitle D or the RCRA Subtitle C requirements are directly applicable. This landfill accepted some hazardous waste before the passage and effective date of RCRA, but was not a hazardous waste landfill. Therefore, the jurisdictional prerequisites are not met for either subtitle. Both subtitles were designed to apply to landfills. Wauconda Sand and Gravel landfill is a sufficiently similar circumstances such that both laws are considered relevant.

The site was viewed in terms of the requirements of both Subtitle C and Subtitle D which were sufficiently similar. The final remedy, will comply with the requirements which are determined to be the most appropriate. For example the cap complies with sanitary landfill requirements.

Alternatives 2 and 4 address capping requirements for the site. Alternative 2 complies with the State of Illinois Sanitary Landfill capping requirements. Alternative 4 complies with the RCRA capping requirements. Both caps are protective and meet respective statutory requirements.

RCRA Subtitle C requirements for caps as proposed in alternative 4 can be considered. The RCRA regulation is applicable to those facilities which operated after promulgation of the regulation in 1980 and/or were granted interim status to operate in the manner provided by the regulation. This regulation requires that the cap minimize liquid migration, minimize maintenance, promote drainage, accommodate subsidence and be less permeable than the bottom liner. Since waste from regrading will be consolidated on-site, RCRA Land Ban Requirements will not be triggered.

Distinguishing which regulation is most applicable, when both are relevant, requires a review of site-specific technical considerations. The site has a portion of the waste saturated within the upper aquifer. This water table aquifer will fluctuate up and down within the waste as dictated by seasonal hydrologic conditions. This fluctuation was noted in the RI. Although it is clear that reducing infiltration will reduce leachate generation, the low concentration of ground water contamination may be more influenced by seasonal fluctuations in the water table/waste saturation interface. Therefore, the zero infiltration provided by the RCRA cap will not likely result in a commensurate reduction in existing ground water concentrations. In addition, the nature of the codisposal operations at the landfill the nature of the existing cap material and the fact that leaching has been occurring for a very long time now, suggests to U.S. EPA that the existing levels of ground water contamination are not likely to significantly increase. Therefore, between the two caps, the Subtitle D sanitary landfill capping requirements were considered to be the most appropriate.

Disposal of Leachate: The State of Illinois has determined that leachate is a special waste based on presently available records of Wauconda landfill disposal and must be handled, treated and disposed of pursuant to Title 35 of Ill. Adm. Code.

Surface Water Standards: The surface water discharge to Mutton Creek will be eliminated by collection of seeps along the northern edge of the landfill. The State of Illinois has determined that leachate seepage must meet drinking water standards in order to allow discharge to Mutton Creek.

Air Standards: The site cover repairs, improved venting system and flares (or treating, as necessary) will result in compliance with all air regulations.

3. Long-term Effectiveness

Continued operation and maintenance of the leachate collection system and maintenance of the Site cover should eliminate the discharge to Mutton Creek and reduce the release of contaminants to the aquifer. The potential for release of leachate to Mutton Creek due to maintenance problems with the leachate collection system will be minimized by the improved cap and the development and implementation of a contingency plan. This contingency plan will describe measures to be taken in case of maintenance problems, and will provide for back-up equipment, and sufficient storage to prevent a release to Mutton Creek. It is expected that, over time, the levels of contaminants in the leachate will decrease. The long-term monitoring will

be effective in detecting any unexpected increase of contaminants in the aquifer in time to implement any further remedial action. The contaminants in the aquifer will further attenuate as they migrate away from the Site.

The upgraded and re-sloped cap would be effective in further reducing infiltration and reducing the release to ground water. It has been reported that methane production continues from 17-57 years. An active venting system and flares can control these emissions during the period of methane production.

4. Reduction of Toxicity, Mobility or Volume

The Site cover repairs will reduce the volume of leachate produced. The collected leachate will be treated off site.

Removal of the leachate collected will eliminate some of the organic hazardous substances, while other hazardous substances will be concentrated in the treatment sludge and properly disposed of off site. Organic compounds that volatilize during collection, transport and treatment will be in low concentrations.

An active gas venting system, if required, would reduce the toxicity and volume of gas emissions from the site.

The leachate that enters the ground water would not be treated except by natural attenuation. The levels of contaminants in the ground water compared to the leachate suggests that some attenuation is occurring. Compounds that do not volatilize, degrade, or adsorb to aquifer materials, will be diluted in the ground water.

5. Short-term Effectiveness

There is no indication that any residential wells currently used for drinking water consumption have been affected by contaminants from the Site. The proposed remedy would eliminate the surface water discharge. Air emissions would be reduced as required. No adverse impact on workers during the sampling or site maintenance is expected if standard health and safety procedures are followed. No adverse impact on the community is expected from the implementation of the remedy.

6. Implementability

No problems are foreseen in implementing Alternative 2.

7. Cost

Comparative estimated costs are presented in Table 2. Alternative 2 is the most cost-effective alternative, and is also protective of human health and the environment. If ground water contamination becomes significant, Alternative 3 will be the most cost-effective remedy. Alternative 4 is more costly without additional reduction of mobility.

8. State Acceptance

The Illinois Environmental Protection Agency (IEPA) concurs with this proposed plan if implemented and maintained by the PRPs.

9. Community Acceptance

Community acceptance is reported in the responsiveness summary included in the Administrative Record. This summary consists of the public comments received on the Supplemental FS report and the Proposed Plan on May 11, 1988 and in a supplemental meeting held December 14, 1988 in Wauconda. If the site upgrades and extensive monitoring and maintenance is implemented the public will support the remedy. While some people wish to have the entire landfill removed, nothing presently measured in the ground water down-gradient from the site nor any EPA guidelines would justify such an extensive and disruptive remedy.

4.0 SUMMARY OF EVALUATION OF ALTERNATIVES

ASSESSMENT FACTORS	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2: CAP IMPROVEMENTS, EMISSION CONTROL, O&M, LEACHATE COLLECTING SYSTEM USE RESTRICTIONS, INVESTIGATIONS	ALTERNATIVE 3: TASKS IN ALTERN. 2 PLUS GROUND WATER PUMPING	ALTERNATIVE 4: TASKS IN ALTERNATIVE 2 PLUS SYNTHETIC LINER CAP
Overall Protection of Human Health and Environment	Risk of exposure due to release to ground water as result of cap deterioration and lack of monitoring. Risk of release to Mutton Creek as a result of cap deterioration and non-operation of leachate collection system. Risk of direct contact exposure to leachate and landfill gases as a result of fence deterioration. Risk of dust emissions and gas exposure of off-site residents to landfill gases as a result of cap deterioration.	Use restrictions on-site will protect against exposure to water above drinking water standards on site. Off-site ground water presently meets drinking water standards. Operation of leachate collection systems will prevent discharge to Mutton Creek. Continued fence repair will prevent direct contact threat. Long term ground water monitoring with action levels for remedial action will protect ground water users from future releases. Site cover repair will eliminate threat of direct contact with wastes and reduce releases to air and ground water. If required an active venting system flare will substantially reduce exposure of off-site residents to landfill gases.	Will provide protection in Alternative 2, plus will reduce risk of migration of hazardous constituents even a short distance off-site during its operation by directing all contaminated ground water to pump out wells.	Will provide protection in Alternative 2 and will decrease the risk of future releases to ground water by reducing infiltration. Will also improve capture of landfill gases.

ASSESSMENT FACTORS	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2:	ALTERNATIVE 3:	ALTERNATIVE 4:
Compliance with ARARs	Will not attain ARARs	Will attain all ARARs except upper aquifer ground water below the site will exceed MCLs.	Will attain all ARARs.	Will attain all ARARs. Also will attain RCRA subtitle C landfill closure requirements.
Long Term Effectiveness and Performance				
a) Magnitude of residual risks	Source will remain, cap will continue to degrade. This will cause and increase in release to ground water and surface water. May also cause threat to direct contact and fugitive emissions. Release to surface water will resume if operation of leachate collection system is discontinued. Fence will deteriorate and increase direct contact threat.	Source will remain but upgrade and maintenance of site cover will substantially reduce risks of future releases to ground water, and surface water. Also will prevent direct contact threat and fugitive emissions. Maintenance of site fence will reduce threat of direct contact with leachate and landfill gases. Operation of the leachate collection system will effectively eliminate discharge of leachate to Mutton Creek. However, leachate will have to be handled. Long-term monitoring with action levels to reopen the ROD will effectly protect against unexpected future releases. Exposure to on-site ground water will be controlled using usage	Source will remain. Will provide control in Alternative 2 plus ground water should not exceed drinking water standards at the perimeter of the site and will remove some secondary contaminant form aquifer. Treatment residuals will have to be handled.	Source will remain. Will provide controls in Alternative 2. Residuals less than in Alternative 2.

ASSESSMENT FACTORS	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2:	ALTERNATIVE 3:	ALTERNATIVE 4:
		restrictions. Off-site ground water will meet drinking water standards. If off-site ground water exceeds drinking water standards remedial action will be elevated. The active venting system if necessary, with flare will substantially reduce exposure of off-site residents to air emissions Will leave secondary contaminants (chloride, sodium, etc.) in aquifer.		

ASSESSMENT FACTORS	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2:	ALTERNATIVE 3:	ALTERNATIVE 4:
b) Adequacy of controls	Inadequate	Controls adequate although potential for erosion of cap because of excessive slopes. 99% destruction of toxic air emissions possible if active venting system is used.	Proven technology except that reverse osmosis for salinity reduction is costly for this volume of flow.	Proven technology although leaks in seams of synthetic liner are possible. Synthetic liner should last indefinitely. Erosion problems reduced as well as maintenance.
c) Reliability of controls	Unreliable	Reliable but cap may take more maintenance.	Reliable	Reliable
Reduction in Toxicity Mobility or Volume (TMV)	No reduction in TMV	No reduction in inherent TMV solid waste. However, mobility of the ground water source will be reduced. Leachate treatment will destroy a small amount of hazardous substances. Active venting system if necessary, with flare will destroy majority of gas emissions.	VOCs in ground water may be transferred to air. Metals such as iron that are not harmful in ground water must be removed prior to discharge to protect aquatic life in Mutton Creek.	Same as Alternative 2 except that the mobility of the source as a whole will be further reduced.

ASSESSMENT FACTORS	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2:	ALTERNATIVE 3:	ALTERNATIVE 4:
Short term effectiveness				
Time Until Protection Achieved	Discharge to Mutton Creek may resume shortly	Continuity	Continuity	Continuity
Protection of community during Remedial Action	No remedial action	Some increase in truck traffic. Potential VOC emissions during relocation of wastes.	No hazard except some increase in truck traffic.	No hazard except some increase in truck traffic.
Protection of workers during Remedial Action	No remedial action	Protect against direct contact and inhalation during leachate handling and maintenance of leachate collection system, and installation of the gas venting system.	Same as Alternative 2 plus precautions in handling chemicals in treatment such as sulfuric acid.	Same as Alternative 2 plus protect against direct contact and inhalation hazards during installation of landfill vents and relocation of wastes.
Adverse Environmental Impacts	Discharge to Mutton Creek may resume	Additional vents required could increase gas emissions through vents.	Salinity of water may affect surface water.	Same as Alternative 2.
Implementability	No remedial action	May need to implement a pump and treatment system in the future, but this would not be difficult. Better venting system requires drilling holes for added pipes.	May be difficult to arrange for discharge of high salinity ground water. Treatment components should be readily obtainable.	Required specialized construction techniques.

ASSESSMENT FACTORS	ALTERNATIVE 1: NO ACTION	ALTERNATIVE 2:	ALTERNATIVE 3: Alt. 2 costs plus	ALTERNATIVE 4:
Cost				
-capital	0	10,510,612*	1,594,500	11,633,800
-O&M	0	174,500*	154,150	131,000
-Present Worth 10% Dr	0	12,155,606	3,068,800	12,886,600
State Acceptance	Not acceptable	State concurs but State may not be willing to pay O&M costs.	State concurs with preference for PRP-funded remedy.	State concurs with preference for PRP-funded remedy.
Community Acceptance	Not acceptable	Accepts	Less acceptable	Accepts

*See cost breakdown in Table 2.

TABLE 2

COMPARISON OF COSTS FOR REMEDIAL ALTERNATIVES

ALTERNATIVE	CAPITAL COST	ANNUAL O&M COST	TOTAL PRESENT (1) WORTH 10% DISCOUNT RATE
1) No Action	0	0	0
2) Cap-upgrade, Active Vents, Monitoring plus O&M (recommended alternative)	10,510,612	174,500	12,155,606(2)
3) Ground Water Pumping and Treatment	Alternate 2 costs plus 1,594,500	154,150	3,068,800
4) Synthetic Liner Cap	11,633,800	131,000	12,886,600(3)
5) Synthetic Liner Cap plus Ground Water Pumping and Treatment	13,046,020	278,570	15,706,800(3)

(1) Does not include costs covered by the existing Consent Order.

(2) See Metcalf and Eddy January 17, 1989 Report on Additional Investigations and Remediation.

(3) Plus venting costs as required.

5.0 THE SELECTED REMEDY

5.1 Recommended Program

The selected remedy is Alternative 2, which includes the following components:

A. Long term monitoring of ground water, air emissions, and Mutton Creek, with action levels to initiate reopening the ROD for additional investigation, and evaluation of additional remedial alternatives.

B. Further upgrade of the site cap possibly including partial relocation of Mutton Creek.

C. Installation and operation of an improved venting system possibly requiring an active flare or other air emissions treatment.

D. Continued operation and maintenance of the leachate collection and venting system, maintenance of the site cap, fence and monitoring well network.

E. Usage restrictions on the shallow aquifer below the site property.

F. Augmented monitoring locations and schedule.

Each of these components are described in more detail in this section.

A. Long term monitoring of ground water, air emissions, and Mutton Creek with action levels to initiate additional investigation, evaluation of remedial alternatives and reopening the ROD:

1. Long term monitoring will continue for 30 years or until shown to be unnecessary. The sampling plan for the long term monitoring can be modified every five years. Following is the expected sampling plan for the first five years.

   a) The following monitoring wells will be sampled annually:

G 305A	OW 407	OW 409
G 305B	OW 408	OW 410
G 310	OW 411	OW 405
G 311A	OW 412	OW 402
OW 403	G 311A	G 201 (replacement)
OW 406		

Newly installed monitoring wells downgradient from site.

Up to 10 residential wells. The residential wells to be sampled will be designated by U.S. EPA or IEPA.

Well in lower aquifer on west side of site and 1500 feet north of OW410.

Mutton Creek will be sampled whenever any leachate discharge to the creek is observed. Mutton Creek will be sampled once within the first two years to a point west of the Highway Route 12.

All these samples will be analyzed for all organic and inorganic compounds included in the Contract Laboratory Program routine analyses, plus water quality parameters.

The laboratory used must demonstrate attainment of detection limits below the maximum contaminant levels listed in 40 CFR 141. Before sampling each monitoring well, the water level in the well will be measured. Each monitoring well will be developed so that ground water samples will have low turbidity.

If an analytical result for a parameter, other than a volatile organic, in a well that is not being sampled quarterly, is greater than primary drinking water standard (40 CFR 141), or if the calculated cancer risk levels exceed levels described in the next section, then the well will be resampled within 60 days of receiving the analytical results.

b) In addition, quarterly samples will be collected three times each year from the following monitoring wells for the next five years:

OW 406	
OW 407	G 310
OW 408	G 201 (replacement)
OW 412	
OW 403	

These samples will be analyzed for only the volatile organic compounds listed in Attachment 1. These quarterly samples combined with the annual sampling will provide four quarterly samples for volatile organics each year for the wells listed above. The laboratory used must demonstrate attainment of detection limits below the maximum contaminant levels listed in 40 CFR 141.

c) Leachate seeps will be sampled and analyzed for pesticides and PCBs.

d) The amount of leachate collected in the leachate collection system will be determined each week. Also the leachate level in the leachate manhole will be measured each week.

e) Once each year the entire site cap will be inspected for cracks, depressions, exposed refuse, erosion damage and gas emissions by walking the site cap on a 75 foot grid. Methane emissions will be checked in cracks using an organic vapor analyses with a flame ionization detector, or equivalent device.

f) During the first year of operation of the active venting system, the total annual methane emission and any hazardous substances contained in such methane emissions in the landfill gases prior to flaring will be measured. The maximum lifetime cumulative carcinogenic risk levels (assuming no controls are present) to a hypothetical resident at the landfill boundary (C.) will be calculated using the measured emission rates, the industrial source complex long term air dispersion model and U.S. EPA's most up-to-date cancer potency factors from the Integrated Risk Information System. If the action level is exceeded a treating system will be evaluated.

During subsequent years, whenever an annual risk assessment indicates that the incremental carcinogenic risk due to the inhalation of landfill gases at the perimeter of the site is less than 10^{-6}, based upon the yearly average maximum gas emission rate, a plan for dismantling the system will be prepared and implemented. The risk assessment is to be presented to U.S. EPA for their review, and must follow the guidelines laid out in the Superfund Public Health Evaluation Manual.

g) Each year a report on the long term ground water monitoring will be prepared and submitted to U.S. EPA and IEPA. This report will include an assessment of the data quality, a tabulation of the data, calculation of representative ground water concentrations, a ground water potentiometric surface map, a comparison of results with relevant standards, and a calculation of the cumulative estimated carcinogenic risk level at each well using the most recent U.S. EPA potency factors. The report will also recommend whether an investigation and feasibility study is needed in order to determine the risks to the public health and environment, and to evaluate remedial action.

Representative ground water concentrations for each parameter will be calculated at each monitoring well by averaging the results from quarterly sampling for the last year, averaging the two samples collected for the last year of sampling or using the single analytical result for that year. Only validated data shall be used for calculating the representative concentrations.

The rate of leachate production and leachate level in the leachate manhole will be correlated to precipitation events in order to evaluate the extent of infiltration through the site cover.

2. Action levels to initiate further investigation, evaluation of alternatives and reopening the ROD.

Additional investigation of contamination of concern will be initiated under the following conditions:

- The representative concentration of a parameter in an off-site, downgradient well exceeds an MCL (40 CFR 141).

or

Using representative concentrations, the cumulative cancer risk level for lifetime drinking water usage (excluding arsenic and vinyl chloride) calculated using U.S. EPA potency factors and representative concentrations in an off-site, downgradient well exceeds 10^{-5}. The 10^{-6} level will not be used because of the difficulty in obtaining reliable measurements for a number of carcinogenic compounds at the 10^{-6} level. For example, the 10^{-6} risk level for benzene (0.7 ug/l), tetrachloroethene (0.7 ug/l) and 1,2-dichloroethane (0.4 ug/l) are near the limits of analytical detectability of these compounds.

and

- The representative concentrations for the parameters of concern significantly exceeds representative background concentrations, and professional judgement indicates that the higher downgradient concentrations in ground water or surface water are likely to indicate a release from the site. This will probably require that the parameter was detected in some leachate samples or could be a product of compounds detected in some leachate samples.

3. Further investigation, alternatives evaluation, and reopening ROD: U.S. EPA and IEPA will review the yearly long-term monitoring report and inspection reports. U.S. EPA and IEPA may determine that a hazardous substance attributable to the Site is above a relevant action level as defined in Section 2. They may also determine that portions of the site cover are not as effective or as well maintained as sanitary landfill caps in Illinois, or that more cost effective alternatives for handling leachate may be available.

   In these situations, additional investigation will be conducted as needed to determine the extent of contamination and extent of hazard or cover problems. For contamination, this will include estimating how long the constituent will likely persist above the action level in off-site ground water. If the constituent is determined to be likely to persist above the action level more than five years, or affect a residential well, then U.S. EPA or IEPA will conduct an evaluation of alternatives for remedial actions as needed, and the record of decision will be reopened. For site cover problems or high rates of leachate production, remedial alternatives will be developed and the record of decision reopened.

4. Further investigation with action levels to initiate evaluation of alternatives. During the first year, hydrogeological, ground water and air investigations will be conducted. The hydrogeological

investigation should include conducting four borings and installation of two to four additional monitoring wells in the upper aquifer north, and northeast of the site, at a distance expected to be near the leading edge of the contaminant plume. It should also include installation of a monitoring well on the west side of the site and 1500 feet north of OW 410.

These wells will be sampled and analyzed for VOCs, and metals indicator parameters. The purpose of these additional monitoring wells is to determine whether hazardous constituents have migrated past the existing monitoring well network.

These monitoring wells will be included in the long term monitoring program and the initial sampling will use the same action levels, investigation and evaluation procedures, as long term monitoring program.

B. Further upgrade of site cap:

The U.S. Army Corps of Engineers inspected the site and determined that additional actions were needed to control erosion from the site, control erosion from Mutton Creek, and to reduce infiltration over the long term (April 15, 1988 memo from the U.S. Army Corps of Engineers). These measures include construction of riprap channels along drainage routes, construction of riprap to protect the toe of the landfill, removing trees and other control measures.

Erosion control measures will be implemented that will satisfy the following criteria:

1. Prevent erosion from reducing the cap effectiveness to less than what is provided by two feet of compacted suitable material at any time and any location due to a 10-year flood event. Suitable material shall contain less than 50% (by weight) sand or coarser material (i.e., less than 0.05 mm as per U.S. DA) and more than 5% (by weight) clay (i.e., greater than 0.0002 mm as per U.S. DA).

2. Minimize long term maintenance.

   Trees located on the landfilled area will be removed and the cap upgraded and repaired in order to reduce infiltration. The existing gas vents and other appurtenances will be upgraded to meet safety guidelines. Vegetation is to be planted near the entrances and in the soil cover to improve the appearance of the site and prevent clay cap desiccation. The potential and benefits of relocation of Mutton Creek will be evaluated during the remedial design phase.

C. Improved landfill gas venting:

During the first year, additional vents will be installed, and emissions of volatile organic compounds from the landfill gas vents and from other emission sources of concern will be measured.

volatile organic compounds from the landfill gas vents and from other emission sources of concern will be measured.
If the calculated maximum carcinogenic ("C_1") risk to nearby residents using U.S. EPA's cancer potency factors exceeds 10^{-6}, then upgraded vents or active treatment systems for controlling the landfill gas emissions will be installed.

D. Continued maintenance:

Continued operation and maintenance of the leachate collection system, gas vents and the active venting system and flares (if employed), the site cap, fence and monitoring system. Action levels to discontinue operation of the active venting system and the flares, and action levels to discontinue operation of the leachate collection system will be established. Provisions for the dismantling of the active venting system, flares and leachate collection system will be established.

1. A program will be implemented for these tasks that will meet the following goals:

   a. Prevent or minimize erosion of the Site cap.

   b. Repair Site cap, as needed, to prevent erosion damage, cracking, exposure of refuse, ponding, promote drainage, and minimize air emissions.

   c. Restrict access to the Site.

   d. Assure the capability of collecting representative samples from the ground water monitoring network.

   e. Prevent discharge of leachate to Mutton Creek.

   f. Assure that the leachate is collected efficiently and disposed of in accordance with State, Federal and Local regulations.

   g. Assure that the overall effectiveness of the site cover is at least equivalent to that of a well maintained sanitary landfill in the State of Illinois at the time of closure (i.e., 2 feet of compacted suitable material, with a vegetative cover; suitable material shall contain less than 50% (by weight) sand or coarser material (less than 0.05 mm as per U.S. Department of Agriculture, U.S. DA) and more than 5% (by weight) clay (greater than 0.0002 mm as per U.S. DA).

The program should include the following tasks:

Inspections
Routine maintenance
Communications with U.S. EPA and IEPA
Response to erosional damage to cap
Response to ponding on cap

Response to fence damage
Response to monitoring well damage
Response to maintenance problems with the leachate collection system that will enable correction of the problems before the leachate is released to Mutton Creek (contingency plan)
Schedule for replacement of major equipment or systems.
Procedures for addressing unexpected repairs or replacement needs.

A review of the results of the remedial action will be conducted with IEPA and the U.S. EPA at the end of each five year period.

2. Action levels to discontinue operation of the active venting system and flares:

whenever an annual risk assessment indicates that the incremental carcinogenic risk due to the inhalation of landfill gases at the perimeter of the site is less then 10^{-6} based upon the yearly average maximum gas emission rate. The risk assessment is to be presented to U.S. EPA for their review, and must follow the guidelines laid out in the Superfund Public Health Evaluation Manual. In this case, a plan for dismantling the system will be prepared and implemented.

3. Action levels to discontinue operation of the leachate collection system: Operation of the leachate collection system can be discontinued if one of the following conditions occur:

   a. Analyses of the leachate demonstrate that the chemical contaminants in the leachate are at concentrations below the respective Primary Maximum Contaminant Levels (40 CFR 141) and below the U.S. EPA, Ambient Water Quality Criteria for protection of fresh water aquatic life.

   b. For a period of one year, no leachate is collected in the leachate collection system under average climate conditions for the area.

   c. It is otherwise demonstrated that if the operation is discontinued, a leachate release to Mutton Creek will not occur.

   In this case, a plan for dismantling the system will be prepared and after an observation period of 5 years, implemented, if the system is not further required.

E. Use restrictions on the shallow aquifer below the site:

Usage restrictions will be implemented for ground water in the shallow aquifer below the site using an agreement with the site owner, notices placed in the plat and deed records.

F. Augmented monitoring locations and schedule:

1. Well Closure:

The following wells will be closed to prevent aquifer contamination: G102, G112, G201, G301, G307, G203A. Well closure will be conducted in a manner that will minimize the potential for migration of surface water into the shallow aquifer or migration of leachate from the landfill into the shallow aquifer. Closure will also be in accordance with any applicable State, Federal and local governmental regulations.

2. Monitoring Well Replacement:

Two new monitoring wells will be installed to replace the following wells that are being closed: G201 and G412.

3. Preventing migration of contaminant to the lower aquifer:

Installation of new wells into the deep aquifer on or near the site can provide an avenue for migration of undesirable contaminants into the lower aquifer in which residential wells are located. To prevent this, the Lake County Health Department has plans to require new well installations to use special procedures. U.S. EPA will require this for on-site well installation using an agreement with the site owner.

5.2 Contingency Plan

The monitoring program will give early warning should the clay cap over the site fail. Prevailing contaminant levels downgradient of the site are well below the MCL acceptable drinking water levels. Should contamination reach the MCL level, or show a consistent, significant (order of magnitude) rise above prevailing levels over more than two monitoring periods, additional samples will be taken to determine if remedial action may be necessary. Because of the variability inherent in sampling and in laboratory analytical techniques, it is not possible to propose objective criteria for reopening the ROD; data must be evaluated in the context of previous data and judgement must be applied prior to initiating action.

Remedial action would definitely be necessary any time the quarterly inspection shows slumping or erosion at any location on the cap.

If localized failure of the cap is obvious, the recommended action is to expose and repair the clay in the area of failure. After repairs are made, the vegetative cover will be restored.

If no failures are obvious and the data demonstrate that transport of the contaminants to the down-gradient groundwater is occurring, then groundwater pumping and treating and possibly the replacement of the cap would be necessary.

A review of the results of the remedial action will be conducted with IEPA and the U.S. EPA at the end of each five-year period commencing with the signing of this ROD. The need for such a review, the results of each review and any actions required as a result of such review will be reported to Congress as required in the Superfund Amendments Reauthorization Act Section 121(c).

5.3 Justification for Modification of the Proposed Plan

The capital cost has been increased from the May 1988 Proposed Plan, not because of a change of remedy but because of: 1) the inclusion of the ultimate cost of an active venting system, should one be required after study of the vent gas composition and rate after cap upgrade and, 2) incorporating the cap upgrade and maintenance cost in this Record of Decision that was specified in the 1985 Record of Decision but not accomplished.

The comment period, subsequent observations, inspection and performance indicate that basic cap condition is not as specified in the 1986 Consent Order. The leachate system is unstable due to the erosion and infiltration of surface water drainage into the cap up-slope of the leachate wells. Repair of these slopes was not adequate to provide stability. Upgrading must now be accomplished to provide an alternative protective of the environment and human health in both the short and long term.

Minor modifications to the details of this recommended program, if required, will be addressed in future explanations of significant changes.

5.4 Statutory Determinations

The selected remedy will be fully protective for all routes of exposures. Direct contact threat will be reduced by maintenance of the site cover and fence. Exposure to air emissions will, if required, be reduced using an active venting system and flares. Exposure to ground water with unsafe concentrations of hazardous substances will be prevented by usage restrictions for on-site ground water, upgrading and maintaining the site cap, and long term monitoring of the ground water. Action levels will be established to initiate further investigation, evaluation of alternatives and reopening the ROD as needed.

Release to Mutton Creek will be prevented by maintenance of the existing site cap and continued operation and maintenance of the leachate collection system. The selected alternative will attain all State and Federal requirements that are applicable or relevant and appropriate to the site action. These are listed in Section 2.2 of this ROD. It is also cost effective. The more expensive remedial actions such as pumping and treatment of ground water and installation of a synthetic liner cap will not provide significant additional protectiveness.

This remedy is the most appropriate solution for the site. Permanent detoxification or immobilization of the source is impractical. Excavation

and treatment of the entire landfill would not be cost effective, cause a number of short term hazards (release of vapor, release of leachate, worker safety), and would not reduce the residual contamination in the aquifer.

ATTACHMENT A

LEACHATE AND UPPER AQUIFER ANALYSES

TABLE 9.2

ATTACHMENT A-1

SUMMARY OF ORGANIC COMPOUND CONCENTRATIONS
IN LEACHATE AND UPPER AQUIFER

Parameter	Background Well	Leachate	Downgradient Wells	On-Site Perimeter Wells
VOCs				
1,1,1-trichloroethane (ug/L)	ND	ND	ND - 5.9	ND - 31
1,1-dichloroethane (ug/L)	ND	ND - 190	ND - 3.3	ND - 4.0
1,2-dichloroethane (ug/L)	ND	ND - 480	ND - 2.2	ND - 1.8
1,2-dichloropropane (ug/L)	ND	ND - 190	ND - 0.9	BDL
2-butanone (ug/L)	ND	ND - 22,000	ND - 6.3	ND - 44
acetone (ug/L)	ND	ND - 25,000	ND - 29	ND - 1,100
benzene (ug/L)	ND	ND - 70	ND - 11	ND - 16
chlorobenzene (ug/L)	ND	ND - 12	ND - 0.9	ND - 2.5
chloroethane (ug/L)	ND	ND - 91	ND - 3.9	ND - 6.9
ethylbenzene (ug/L)	ND	ND - 140	ND - 0.8	ND - BDL
methylene chloride (ug/L)	ND	ND - 11,000	ND - 1400	ND - 29
tetrachloroethene (ug/L)	ND	ND - 120	ND - 1.8	ND - 14
toluene (ug/L)	ND	ND - 550	ND - 1.1	ND - 0.8
trans-1,2-dichloroethene (ug/L)	ND	ND - 730	ND - 26	ND - 24
trichloroethene (ug/L)	ND	ND - 200	ND - 6.6	ND - 2.2
trichlorofluoromethane (ug/L)	ND	NA	ND - 8	ND -
vinyl chloride (ug/L)	ND	ND - 77	ND - 2.8	30
total xylenes (ug/L)	ND	BDL - 430	ND - 5.3	ND
BNAs				
1,4-dichlorobenzene (ug/L)	ND	ND - 30	ND - BDL	ND
2-methylnapthalene (ug/L)	ND	350	ND - 0.3	ND
4-methylphenol (ug/L)	ND - 0.4	ND - 11,000	ND	BDL
isophorone	-	1700	-	6.2

continued....

TABLE 9.2 ATTACHMENT A-2

SUMMARY OF ORGANIC COMPOUND CONCENTRATIONS
IN LEACHATE AND UPPER AQUIFER

Parameter	Background Well	Leachate	Downgradient Wells	On-Site Perimeter Wells
BNAs (cont'd)				
benzoic acid (ug/L)	ND	6200	ND - 2.2	BDL
bis (2-chloroethyl) ether (ug/L)	ND	ND	ND - 5.7	ND
bis (2-ethylhexyl) phthalate (ug/L)	ND - 5.8	ND - 11	ND - 45	ND - 26
butylbenzylphthalate (ug/L)	ND	ND	ND - 0.7	ND
di-n-butylphalate (ug/L)	ND	ND - 26	ND - 1.3	BDL
di-n-octylphthalate (ug/L)	ND - 1	ND	ND - 6.4	ND - 0.9
n-nitrosodiphenylamine (ug/L)	ND	ND	ND - 1.3	ND - 10
phenol (ug/L)	ND	7800	ND - 2.2	ND - 0.6
Pesticide/PCB's				
alpha-BHC (ug/L)	ND	ND	ND - 0.026	ND - 0.007
beta-BHC (ug/L)	ND	ND	ND - 0.007	ND
delta-BHC (ug/L)	ND	ND	ND - 0.02	ND
dieldrin (ug/L)	ND	ND	ND - 0.009	ND - 0.006
gamma-BHC (ug/L)	ND	ND	ND - 0.009	ND - 0.025
heptachlor (ug/L)	ND	ND	ND - 0.14	ND - 0.100

Notes:
1) Background well represented by OW411.
2) Downgradient wells represented by G203A, G305B, OW402, OW403, OW404, OW405 OW406, OW407, OW408.
3) On-Site Perimeter Wells represented by G112, G113, G114, G201, G303B, G304, G310, G117
4) ND - not detected.
5) BDL - below detection limit.
6) NA - not analyzed.

TABLE 9.3

SUMMARY OF METALS CONCENTRATIONS IN LEACHATE AND UPPER AQUIFER
UNFILTERED SAMPLES

Metal	Background Well	Leachate	Downgradient Wells	On-Site Perimeter Wells
Aluminum (mg/L)	0.067 - 0.434	ND - 12.5	ND - 9.1	ND - 51.7
Antimony (mg/L)	ND - 0.066	ND - 0.024	ND - 0.069	ND - 0.056
Arsenic (mg/L)	ND	0.012 - 0.179	ND - 0.030	ND - 0.142
Barium (mg/L)	0.093 - 0.121	0.268 - 0.788	ND - 0.604	0.027 - 0.38
Beryllium (mg/L)	ND	ND	ND	ND - 0.0063
Boron (mg/L)	ND	6.1 - 23	ND - 1.20	ND - 1.62
Cadium (mg/L)	ND - 0.0016	ND - 0.0011	ND - 0.043	ND - 0.0036
Calcium (mg/L)	91.2 - 94.3	37.5 - 2,600	62.9 - 243	34.2 - 679
Chromium (mg/L)	0.011 - 0.027	ND - 0.165	ND - 0.036	ND - 0.19
Cyanide, total (mg/L)	ND	ND - 0.043	ND	ND - 0.0063
Hexavalent Chromium (mg/L)	ND	ND - 0.076	ND - 0.009	ND - 0.054
Cobalt (mg/L)	ND - 0.015	ND - 0.37	ND - 0.050	ND - 0.067
Copper (mg/L)	0.017 - 0.027	ND - 0.45	ND - 0.082	ND - 0.7
Iron (mg/L)	0.711 - 1.26	4.57 - 1,180	2.78 - 45.6	1.61 - 284
Lead (mg/L)	ND - 0.0055	ND - 0.047	ND - 0.441	ND - 0.45
Magnesium (mg/L)	41.5 - 42.1	81.8 - 706	28.7 - 142	26.4 - 312
Manganese (mg/L)	0.250 - 0.362	0.104 - 22	0.039 - 1.03	0.059 - 2.14
Mercury (mg/L)	ND	ND	ND - 0.0036	ND - 0.004
Nickel (mg/L)	ND - 0.033	0.06 - 0.589	ND - 0.057	ND - 0.192
Potassium (mg/L)	5.11 - 5.51	49.5 - 692	1.14 - 89.6	4.94 - 133
Selenium (mg/L)	ND	ND - 0.027	ND	ND - 0.035
Silver (mg/L)	ND - 0.030	ND - 0.049	ND - 0.018	ND - 0.023
Sodium (mg/L)	9.49 - 9.89	1,450 - 3,280	5.3 - 898	10.9 - 389
Thallium (mg/L)	ND	ND	ND	ND - 0.0021
Tin (mg/L)	ND	ND - 0.035	ND - 0.023	ND - 0.022
Vanadium (mg/L)	0.026 - 0.060	ND - 0.159	ND - 0.054	ND - 0.577
Zinc (mg/L)	0.02 - 0.036	0.1 - 44.2	ND - 27.9	ND - 2.07

Notes:

1) Background well represented by OW411.
2) Downgradient wells represented by G305B, OW408, OW407, OW406, G203a, OW403, OW404, OW405, OW402.
3) On-site perimeter well represented by G112, G113, G114, G117, G201, G303A, G303B, G304, G310.
4) ND - not detected.

TABLE 9.4

SUMMARY OF METALS CONCENTRATIONS IN LEACHATE AND UPPER AQUIFER

FILTERED SAMPLES

Metal	Background Well	Leachate	Downgradient Wells	On-Site Perimeter Wells
Aluminum (mg/L)	ND - 0.328	ND - 12.5	ND - 1.08	ND - 0.8
Antimony (mg/L)	ND - 0.075	ND - 0.024	ND - 0.011	ND - 0.009
Arsenic (mg/L)	ND	0.012 - 0.179	ND - 0.022	ND - 0.026
Barium (mg/L)	0.088 - 0.117	0.268 - 0.788	ND - 0.45	ND - 0.316
Beryllium (mg/L)	ND	ND	NA	NA
Boron (mg/L)	ND	6.1 - 23	ND - 1.2	ND - 1.7
Cadmium (mg/L)	ND	ND - 0.0011	ND - 0.007	ND - 0.0016
Calcium (mg/L)	88.7 - 91.5	37.5 - 2,600	36.1 - 232	25.2 - 154
Chromium (mg/L)	ND - 0.024	ND - 0.165	ND - 0.028	ND - 0.017
Cyanide, total (mg/L)	ND	ND - 0.043	ND - 0.01	ND - 0.016
Hexavalent Chromium (mg/L)	ND	ND - 0.076	NA	NA
Cobalt (mg/L)	ND - 0.014	ND - 0.37	ND - 0.05	ND - 0.0076
Copper (mg/L)	0.011 - 0.025	ND - 0.035	ND	ND - 0.01
Iron (mg/L)	0.416 - 0.437	4.57 - 1,180	0.031 - 9.02	ND - 2.71
Lead (mg/L)	ND	ND - 0.047	ND - 0.035	ND - 0.01
Magnesium (mg/L)	40.4 - 41.0	81.8 - 706	27.3 - 142	18.0 - 85.7
Manganese (mg/L)	0.265 - 0.349	0.104 - 22	0.03 - 1.05	0.022 - 0.287
Mercury (mg/L)	ND - 0.0022	ND	ND - 0.0004	ND - 0.0002
Nickel (mg/L)	ND - 0.032	0.06 - 0.589	ND - 0.048	ND - 0.032
Potassium (mg/L)	4.59 - 5.54	49.5 - 692	1.52 - 86.5	3.05 - 126
Selenium (mg/L)	ND	ND - 0.027	ND - 0.0051	ND
Silver (mg/L)	ND - 0.026	ND - 0.049	ND	ND - 0.01
Sodium (mg/L)	9.14 - 9.83	1,450 - 3,280	5.3 - 617	10.9 - 382
Thallium (mg/L)	ND	ND	ND - 0.002	ND
Tin (mg/L)	ND	ND - 0.035	ND - 0.034	ND - 0.0054
Vanadium (mg/L)	0.023 - 0.056	ND - 0.159	ND - 0.027	ND - 0.017
Zinc (mg/L)	0.031 - 0.038	0.1 - 44.2	0.012 - 0.2	ND - 0.183

Notes:

1) Background well represented by OW411.
2) Downgradient wells represented by G305B, OW408, OW407, OW406, G203A, OW403, OW404, OW405, OW402.
3) On-site perimeter wells represented by G112, G113, G114, G117, G201, G303A, G303B, G304, G310.
4) ND - not detected
5) NA - not analyzed

TABLE 4.9

INORGANIC INDICATOR PARAMETER
CONCENTRATION DATA - ON-SITE PERIMETER WELLS

Monitor Well No.	Inorganic Indicator Parameters (ug/L)(1)					
	Arsenic		Lead		Nickel	
	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered
G112	5.3	(3.7)	7.1	1.6	35.7	19.0
G113	NA	NA	NA	NA	NA	NA
G114	31.3	24.0	33.3	(2.1)	60.7	31.3
G117	(10.0)	(10.0)	(5.0)	(5.0)	(10.0)	(10.0)
G201	13.0	NA	60.7	NA	37.7	NA
G303A	19.0	7.0	88.0	7.0	38.0	20.0
G303B	4.1	3.1	242.5	5.0	72.0	(5.0)
G304	63.4	7.6	49.8	1.9	86.8	19.2
G310	(3.7)	3.1	6.2	(2.1)	18.3	15.0
Aquifer Average(2)	18.7	8.4	61.6	3.5	44.9	17.1
MCL	50		50		15.4	
WQC					150	
EPA Guidance Guidance (3)						
Background (3.7) (OW411)	(3.7)		3.1	(1.6)	26.5	26.0

(1) Numbers are averages of valid concentrations. (See text) Numbers in parentheses are averages where all data was reported as non-detect without qualifiers.
NA - Not Analyzed

2) Averaging procedures:
- Data for duplicate samples were averaged to provide a single value for each round in each well.
- Estimates below detection limit were averaged as valid data.
- Detection limit was used for purposes of averaging in non-detects except for those instances of poor sensitivity which resulted in unacceptably high detection limits. (See text)
- Values for each round in each well were averaged to provide the well averages reported above.
- Well averages, including non-detects, were averaged to develop the aquifer averages reported in the above table.

) EPA Guidance - 50 FR, November 13, 1985.

TABLE 4.10

ORGANIC INDICATOR PARAMETER
CONCENTRATION DATA - ON-SITE PERIMETER WELLS

Monitor Well No.	Organic Indicator Parameters (ug/L)(1)				
	Tetrachloroethene	Trichloroethene	Vinyl Chloride	Benzene	N-Nitrosodiphenylamine
G112	7.7	3.4	1.1	2.7	2.0
G113	6.0	(3.0)	(*)	9.0	6.0
G114	3.2	1.2	6.9	3.6	2.9
G117	8.0	(4.0)	(*)	(3.0)	(5.0)
G201	1.0	1.8	2.0	1.7	(0.4)
G303A	(3.0)	(2.5)	(1.0)	9.0	8.0
G303B	(1.5)	0.4	1.5	(0.6)	1.3
G304	5.0	1.8	(1.0)	4.4	1.7
G310	0.2	1.8	5.5	1.3	1.9
Aquifer Average(2)	4.0	2.2	2.7	3.9	3.2
Criteria(3)					
MCL		5.0	2.0	5.0	
WQC Risk 10^{-6}	0.88	2.8	2.0	0.88	7
10^{-5}	8.8	28	20.0	8.8	70
10^{-4}	88.0	280	200.0	88.0	700

(1) Numbers are averages of valid concentrations. (See text)
Numbers in parentheses are averages where all data was reported as non-detect without qualifiers.
(*) - all data reported as non-detect without qualifiers and all analyses are instances of poor sensitivity resulting in unacceptably high detection limits.

(2) Averaging procedures:
- Data for duplicate samples were averaged to provide a single value for each round in each well.
- Estimates below detection limit were averaged as valid data.
- Detection limit was used for purposes of averaging in non-detects except for those instances of poor sensitivity which resulted in unacceptably high detection limits. (See text)
- Values for each round in each well were averaged to provide the well averages reported above.
- Well averages, including non-detects, were averaged to develop the aquifer averages reported in the above table.

(3) MCL - Maximum contaminant levels, National Drinking Water Standards

TABLE 4.11

EXPOSURE POINT CONCENTRATIONS - UPPER AQUIFER GROUNDWATER DOWNGRADIENT OF SITE (INORGANICS)

Monitor Well No.	Inorganic Indicator Parameter (ug/L)(1)					
	Arsenic		Lead		Nickel	
	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	Filtered
G203A	4.6	1.5	171.1	12.3	27.8	18.3
G305B	(3.7)	NA	3.1	NA	16.0	NA
OW402	14.1	9.3	9.4	(2.6)	40.3	37.7
OW403	(4.1)	(1.0)	5.4	(3.0)	16.7	5.0
OW404	10.1	(1.0)	7.6	(3.0)	23.3	6.0
OW405	(3.7)	(1.0)	6.4	(3.0)	14.3	8.0
OW406	6.5	(1.0)	5.1	(3.0)	29.7	12.0
OW407	(3.7)	(2.8)	6.2	2.8	24.0	13.5
OW408	4.9	(1.0)	8.9	(3.0)	43.7	25.5
Aquifer Average(2)	6.2	2.1	24.8 6.5 *	4.1 2.9 *	26.2	15.8
MCL(3)	50		50			
WQC(3)					15.4	
HA(3)					150	
Background (OW411)	(3.7)	(3.7)	3.3	(1.6)	26.5	26.0

(1) Numbers are averages of valid concentrations. (See text) Numbers in parentheses are averages where all data was reported as non-detect without qualifiers.
NA - Not Analyzed

(2) Averaging procedures:
- Data for duplicate samples were averaged to provide a single value for each round in each well.
- Estimates below detection limit were averaged as valid data.
- Detection limit was used for purposes of averaging in non-detects except for those instances of poor sensitivity which resulted in unacceptably high detection limits. (See text)
- Values for each round in each well were averaged to provide the well averages reported above.
- Well averages, including non-detects, were averaged to develop the aquifer averages reported in the above table.

* Average without Well G203A, assuming the lead value is anomalis.

(3) MCL - Maximum contaminant level.
WQC - Water Quality Criteria.
HA - EPA Health Advisory

TABLE 4.12

EXPOSURE POINT CONCENTRATIONS - UPPER AQUIFER GROUNDWATER DOWNGRADIENT OF SITE (ORGANICS)

Monitor Well No.	Organic Indicator Chemicals (ug/L)(1) Tetrachloroethene	Trichloroethene	Vinyl Chloride	Benzene	N-Nitrosodiphenylamine
G203A	(0.9)	1.6	1.3	4.3	1.0
G305B	(0.8)	(0.4)	0.7	(0.9)	(0.5)
OW402	(1.2)	1.0	0.9	2.6	(0.5)
OW403	(0.6)	0.3	1.9	(0.9)	(0.4)
OW404	(0.6)	(0.4)	(1.0)	(0.6)	(0.5)
OW405	(1.0)	(0.4)	(0.9)	(0.6)	(0.4)
OW406	(0.6)	(0.4)	0.9	(0.6)	(0.4)
OW407	(1.0)	(0.4)	1.6	(0.6)	(0.5)
OW408	1.3	(0.4)	1.3	(0.6)	(0.5)
Aquifer Average(2)	0.9	0.6	1.2	1.3	0.5
Criteria(3)					
MCL		5.0	2.0	5.0	
WQC Risk 10^{-6}	0.88	2.8	2.0	0.88	7
10^{-5}	8.8	28	20.0	8.8	70
10^{-4}	88.0	280	200.0	88.0	700

(1) Numbers are averages of valid concentrations. (See text)
Numbers in parentheses are averages where all data was reported as non-detect without qualifiers.

(2) Averaging procedures:
- Data for duplicate samples were averaged to provide a single value for each round in each well.
- Estimates below detection limit were averaged as valid data.
- Detection limit was used for purposes of averaging in non-detects except for those instances of poor sensitivity which resulted in unacceptably high detection limits. (See text)
- Values for each round in each well were averaged to provide the well averages reported above.
- Well averages, including non-detects, were averaged to develop the aquifer averages reported in the above table.

(3) MCL - Maximum contaminant levels, National Drinking Water Standards
WQC - Water Quality Criteria for risk levels of 10^{-4}, 10^{-5} and 10^{-6}.

ATTACHMENT B

WASTE SUMMARY

SUMMARY OF HAZARDOUS WASTE DISPOSAL BY INDUSTIRES AT THE WAUCONDA SAND AND GRAVEL SITE FOR WHICH U.S. EPA HAS SOME LIMITED INFORMATION (1)

Waste Type	Hazardous Waste Disposal by Industries Quantity	Hazardous Waste Disposal by Industries yd^3	RCRA Hazardous Waste Disposal(2) yd^3
30% sulfuric acid	330 barrels	82	82
Cr^{+6} dust	415 tons	415	415
WWTP sludge		140	140
Pigments containing heavy metals	1430 lbs.	1	1
Ink roller alcohol based solvent. Ignitable and contained Pb, Cr, Ni, Zn, Cd, Cu.	660 drums	167	167
Trash, liquid waste waste oil	unknown	10200 (3) (estimated)	
Waste including a small quantity of partially filled spray paint cans		24000 (4) (estimated)	
Ink sludge	62 drums	16	
Carbon, tars latex	73 drums	18	
Grinding sludge and slag		216	
Pigments	unknown	570 (3) (estimated)	

ATTACHMENT C

GROUNDWATER ANALYSES -

COMPARISON DATA SUMMARY

Refuse including
small quantitiea of
adhesives & solvents

$$\frac{3900\ (4)}{39725} \qquad \frac{}{805}$$

Estimated Hazardous waste disposal = $\frac{39725}{3x10^{-6}} \times 100 = 1.3\%$

Known RCRA hazardous waste disposal = $\frac{805}{3x10^{-6}} \times 100 = 0.03\%$

(1) This Table is not meant for negotiationg purposes.

(2) Only waste for which documentation is available that indicates that waste would probably have met present definition of a hazardous waste under the Resource Conservation and Recovery Act.

(3) Estimated by multiplying number of employees by a hazardous waste generation factor from Weston, 1970.

(4) No quantitative estimate of hazardous waste disposal available; so total waste disposal assumed to be hazardous.

B. Cont.

Upper Aquifer On-site Perimeter Wells
(Maximum Concentration in mg/l for Rounds 6 and 7)[1]

Well	Arsenic[2]	Benzene	Tetra-chloroethylene	Trichloro-ethylene	Vinyl Chloride	N-Nitroso-diphenylamine
G112	F ND UF 0.0064	0.0031[3]	ND	ND	0.0011	ND
G113	F ND UF ND	ND	ND	ND	ND	ND
G114	F 0.026 UF 0.028	0.0054	ND	ND	0.0008[3]	ND
G117	F ND UF ND	ND	ND	ND	ND	ND
G201	F ND UF 0.027	0.0026	0.0017[3]	0.0021	0.0022	ND
G303A	F ND UF ND	ND	ND	ND	ND	ND
G303B	F ND UF 0.004	ND	ND	ND	0.0017	ND
G304	F 0.0049 UF 0.042	0.0028	ND	ND	ND	ND
G310	F ND UF ND	0.0013	0.0002	0.0022	0.0091	ND

Lower Aquifer Wells
(Maximum Concentration in mg/l for Rounds 6 and 7)[1]

Well	Arsenic[2]	Benzene	Tetra-chloroethylene	Trichloro-ethylene	Vinyl Chloride	N-Nitroso-diphenylamine
G311B	F ND UF ND	0.0044[3]	ND	ND	ND	ND
OW409	F ND UF ND	ND	0.0008[3]	0.012	ND	ND
OW410	F ND UF ND	ND	0.0006[3]	0.0039	ND	0.014

TABLE 1

TABULATION OF PERCENTAGE OF TIMES DETECTED IN ALL SAMPLING ROUNDS COMPARING SITE-IMPACTED WELLS WITH WELLS NOT SITE IMPACTED

PARAMETER	DOWN-GRADIENT WELLS (1)	WELLS NOT SITE IMPACTED	
		CROSS-GRADIENT (2) UP-GRADIENT	LOWER-AQUIFER PLUS CROSS-GRADIENT (3) UP-GRADIENT
Arsenic (unfiltered) (4)	36%	27%	9%
Arsenic (filtered) (4)	20%	0%	0%
1,1 Dichloroethane	27%	7%	13%
1,2 Dichloroethane	7%	0%	0%
1,2 Dichloropropane	10%	0%	0%
Benzene	30%	21%	10%
Chlorobenzene	16%	0%	0%
Chloroethane	24%	0%	0%
Trans-1,2-dichloroethene	36%	0%	0%
Vinyl chloride	46%	0%	0%
Tetrachloroethene	20%	14%	26%
Trichloroethene	23%	14%	21%

1. These include on-site and off-site down-gradient perimeter wells G201, G310, G114, G113, G112, G304, G303A, G117, G303B, G305B, OW408, G116, OW407, OW406, G203A, G309, OW403, G106, OW402. Total of 70 analyses except for 53 for arsenic (unfiltered) and 45 for arsenic (filtered).

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FOOTNOTES

[1] Data from rounds 6 and 7 were used to determine maximum concentrations detected for each chemical of concern. "ND" indicates that the chemical was not detected.

[2] F: Filtered Results
UF: Unfiltered Results

Unfiltered results were used to indicate "worst case" scenario.

[3] Value used for dose is an estimated concentration below detection limits.

TABLE 2

TABULATION OF PERCENTAGE OF TIMES DETECTED
IN LAST TWO SAMPLING ROUNDS (ROUNDS 6 & 7) COMPARING
SITE-IMPACTED WELLS WITH WELLS NOT SITE IMPACTED

PARAMETER	DOWN-GRADIENT WELLS (1)	WELLS NOT SITE-IMPACTED	
		CROSS-GRADIENT (2) UP-GRADIENT	LOWER AQUIFER PLUS CROSS-GRADIENT (3) UP-GRADIENT
Arsenic (unfiltered)	41%	0%	0%
1,1 Dichloroethane	48%	0%	14%
1,2 Dichloroethane	17%	0%	0%
1,2 Dichloropropane	21%	0%	0%
Benzene	28%	0%	4%
Chlorobenzene	21%	0%	0%
Chloroethane	55%	0%	0%
Trans-1,2-dichloroethene	38%	0%	0%
Vinyl Chloride	76%	0%	0%
Tetrachloroethene	14%	0%	29%
Trichloroethene	17%	0%	21%

1. These include on-site and off-site down gradient perimeter wells G201, G310, G114, G112, G303B, G305B, OW408, OW407, OW406, G203A, OW403, OW402. A total of 29 analyses.

2. Wells shallow aquifer G311A, OW411. Total of 5 analyses.

3. Wells in (2) plus deep aquifer wells OW409, OW410, G311B, and rounds 6 & 7 residential wells.

4. Values less than 4 ug/l counted as not detected (see Table 1).

TABLE 2

TABULATION OF PERCENTAGE OF TIMES DETECTED
IN LAST TWO SAMPLING ROUNDS (ROUNDS 6 & 7) COMPARING
SITE-IMPACTED WELLS WITH WELLS NOT SITE IMPACTED

PARAMETER	DOWN-GRADIENT WELLS (1)	WELLS NOT SITE-IMPACTED	
		CROSS-GRADIENT (2) UP-GRADIENT	LOWER AQUIFER PLUS CROSS-GRADIENT (3) UP-GRADIENT
Arsenic (unfiltered)	41%	0%	0%
1,1 Dichloroethane	48%	0%	14%
1,2 Dichloroethane	17%	0%	0%
1,2 Dichloropropane	21%	0%	0%
Benzene	28%	0%	4%
Chlorobenzene	21%	0%	0%
Chloroethane	55%	0%	0%
Trans-1,2-dichloroethene	38%	0%	0%
Vinyl Chloride	76%	0%	0%
Tetrachloroethene	14%	0%	29%
Trichloroethene	17%	0%	21%

1. These include on-site and off-site down gradient perimeter wells G201, G310, G114, G112, G303B, G305B, OW408, OW407, OW406, G203A, OW403, OW402. A total of 29 analyses.

2. Wells shallow aquifer G311A, OW411. Total of 5 analyses.

3. Wells in (2) plus deep aquifer wells OW409, OW410, G311B, and rounds 6 & 7 residential wells.

4. Values less than 4 ug/l counted as not detected (see Table 1).

2. Shallow aquifer Wells G104, G302, G115, G103, OW401, OW411, G311A. Total of 14 analyses except 7 for arsenic. G115, not used for volatile organics because of high detection limit.

3. Wells in (3) plus deep aquifer wells OW409, OW410, G311B, and round 6 & 7 residential wells. Total of 34 analyses except 17 for arsenic.

4. Values less than 4 ug/l counted as not detected. This is because Hazelton Laboratory reached much lower detection limits that other labs but only analyzed only one background out of 15 analyses. Counting detects less than 4 ug/l could bias the results by showing an impact down gradient that is not real.

Acetone	all data	15/28	9/20	4/30	13/50	4/10	7/35
	rounds 6&7	3/16	1/12	1/17	2/29	0/5	1/28
Benzene	all data	15/38	12/30	9/40	21/70	3/14	4/39
	rounds 6&7	7/16	5/12	3/17	8/29	0/5	1/28
Chloro-benzene	all data	10/38	10/30	1/40	11/70	0/14	0/39
	rounds 6&7	5/16	5/12	1/17	6/28	0/5	0/28
Benzoic Acid	all data	8/36	3/28	3/29	6/57	0/11	0/36
	rounds 6&7	6/16	2/12	3/17	5/29	0/5	2/36
(2-ethyl-hexyl phthalate	all data	9/38	7/30	11/40	18/70	2/15	14/40
	rounds 6&7	8/16	6/12	10/17	16/29	2/5	14/28

TABULATION OF NUMBER OF DETECTIONS PER TOTAL ANALYSES FOR DIFFERENT GROUPS OF WELLS AT THE WAUCONDA SAND & GRAVEL SITE

PARAMETERS	Data Used.	On-Site(1) Wells	On-Site(2) Perimeter Wells	Down-Gradient(3) Perimeter Well	On-Site and Down Gradient Perimeter Wells	Up-Gradient(4) and Cross Gradient Upper Aquifer Wells	Up-Gradient(5) Cross-Gradient Plus Lower Aquifer
111 Trichloro-ethane	all data	2/38	2/30	8/40	10/70	2/14	6/39
"	rounds 6&7	1/16	1/12	2/17	3/29	0/5	4/28
11 Dichloro-ethane	all data	15/38	8/30	11/40	19/70	1/14	5/39
	rounds 6&7	10/16	6/12	8/17	14/29	0/5	4/28
12 Dichloro-ethane	all data	5/38	3/30	2/40	5/70	0/14	0/39
	rounds 6&7	5/16	3/12	2/17	5/29	0/5	0/28
12 Dichloro-propane	all data	8/38	5/30	2/40	7/70	0/14	0/39
	rounds 6&7	6/16	4/12	2/17	6/29	0/5	0/28
2 Butanone	all data	9/28	4/20	0/30	4/50	1/10	3/35
	rounds 6&7	1/16	1/12	0/17	0/29	1/5	2/28

Arsenic * Unfiltered	all data	14/29	12/23	7/30	19/53	3/11	3/34
	rounds 6&7	11/14	8/12	4/17	12/29	0/5	0/28
Arsenic * Filtered	all data	8/23	8/21	1/24	9/45	0/7	0/17
Cadmium Unfiltered	all data	5/29	5/26	12/30	17/56	5/11	6/34
Mercury Unfiltered	all data	5/29	5/23	4/30	9/53	3/11	7/34
Chloro-ethane	all data	11/38	7/30	10/40	17/70	0/14	0/39
	rounds 6&7	10/16	6/12	10/17	16/29	0/5	0/28
Ethyl-benzene	all data	1/38	1/30	4/40	5/70	0/14	2/39
	rounds 6&7	0/16	0/12	4/17	9/29	0/5	2/28

* Only arsenic above 4 ug/l was counted as detected

di-n-butylphthalate	all data	7/38	4/30	6/40	10/70	1/15	7/40
	rounds 6&7	3/16	3/12	5/17	8/29	0/5	4/28
di-n-octylphthalate	all data	3/38	1/30	2/40	3/70	2/15	7/40
	rounds 6&7	3/16	1/12	2/17	3/29	1/5	6/28
n-nitroso diphenylamine	all data	9/38	9/30	2/40	11/70	4/15	7/40
	rounds 6&7	0/16	0/12	1/17	1/29	0/5	1/28
phenol	all data	8/38	5/30	4/40	9/70	2/15	5/40
	rounds 6&7	5/16	3/12	2/17	5/29	1/5	4/28
Heptachlor	all data	1/38	1/30	4/40	5/70	1/15	2/40
	rounds 6&7	0/16	0/12	0/17	0/29	0/5	0/28

Vinyl chloride	all data	20/38	13/30	19/40	32/70	0/14	0/39
	rounds 6&7	10/16	6/12	16/17	22/29	0/5	0/28
Xylenes	all data	2/33	1/27	8/30	9/57	1/11	5/36
	rounds 6&7	2/16	1/12	8/17	9/29	0/5	4/28
1,4 dichloro-benzene	all data	3/38	3/30	2/40	5/70	0/15	2/40
	rounds 6&7	0/16	0/12	0/17	0/29	0/5	0/28
4 methyl-phenol	all data	6/38	2/30	0/40	2/70	1/15	2/40
	rounds 6&7	6/16	2/12	0/17	2/29	1/5	2/28

Methylene chloride	all data	10/38	8/30	15/40	23/70	4/14	11/39
	rounds 6&7	5/16	3/12	8/17	11/29	2/5	9/28
Tetrachloroethane	all data	12/38	11/30	3/40	14/70	2/14	10/39
	rounds 6&7	3/16	3/12	1/17	4/29	0/5	8/28
Toluene	all data	9/38	6/30	9/40	15/70	2/15	10/39
	rounds 6&7	5/16	4/12	6/17	10/29	0/5	7/28
Trans 12 dichloroethene	all data	21/38	14/30	11/40	25/70	0/14	0/39
	rounds 6&7	9/16	5/12	6/17	11/29	0/5	0/28
Trichloroethene	all data	14/38	9/30	7/40	16/70	2/14	8/39
	rounds 6&7	5/16	3/12	2/17	5/29	0/5	6/28

ATTACHMENT D

MUTTON CREEK - SURFACE WATER AND SEDIMENT ANALYSES

1) Wells, G301, G201, G310, G114, G113, G112, G304, G303A, G117, G303B.

2) Wells G201, G310, G114, G113, G112, G304, G303A, G117, G303B,

3) Wells G305B, OW408, G116, OW407, OW406, G203A, G309, OW403, G106, OW402.

4) Wells G104, G302, G115, G103, OW401, OW411, G311A, G115 was not used for volatile organics because of high detection limits.

5) Wells listed in 4) plus OW409, OW41G, G311B, and residential well in rounds 6&7.

5HE-12:RBoice:mt:CERCLA:1/13/88:Lexitron Disk #3
revised 2/1/88

Cont. 7

TABLE 8.2

SUMMARY OF MUTTON CREEK SURFACE WATER ANALYTICAL DATA

Parameter	Upstream	Leachate	Downstream
General Water Quality Parameters			
Chemical Oxygen Demand (mg/L)	38 - 40	930 - 36,000	61
Chloride (mg/L)	25 - 27	1,800 - 4,500	38
Conductivity (umhos)	310		315
Dissolved Oxygen (mg/L)	10.38 - 10.57		9.48
Ammonia as N (mg/L)	0.37 - 0.41	460 - 760	2.0
Nitrate/Nitrite as N (mg/L)	0.22 - 0.23	0.2 - 1.4	0.20
Sulfate (mg/L)	70 - 72	ND - 1,400	71
Total Dissolved Solids (mg/L)	360 - 370	5,800 - 25,000	400
Total Organic Carbon (mg/L)	36 - 46	380 - 14,000	31
Total Suspended Solids (mg/L)	2 - 3		4
Turbidity (NTU)	2	48 - 120	2
pH	7.75		7.8

Notes:

1) Upstream data represented by WS101 and SW3
2) Downstream data represented by WS301 and SW1
3) Leachate data represented by LW503, LS1, LS2, LS3, LS4, WS002, WS401
4) ND - not detected
5) BDL - below detection limit
6) Complete surface water data base provided in Appendix C

TABLE 8.2

SUMMARY OF MUTTON CREEK SURFACE WATER ANALYTICAL DATA

Parameter	Upstream	Leachate	Downstream
Volatile Organics (ug/L)			
2-Butanone	ND	ND - 22,000	ND - 2.3
Benzene	ND	ND - 70	ND - 0.2
Methylene Chloride	ND - 0.2	ND - 11,000	ND - 1.1
Base/Neutral/Acids (ug/L)			
Butyl benzylphthalate	ND	ND	ND - BDL
Di-n-butylphthalate	ND - 0.1	ND - 26	ND
Pesticides/PCBs (ug/L)			
4,4'-DDD	ND	ND	ND - 0.13
Dieldrin	ND	ND	ND - 0.046
Endrin	ND	ND	ND - 0.029
Heptachlor	ND	ND	ND - 0.026
Heptachlor Epoxide	ND	ND	ND - 0.032
Metals (mg/L)			
Aluminum	ND - 1.07	ND - 12.5	ND - 0.884
Barium	ND - 0.032	0.268 - 0.788	0.032 - 0.34
Calcium	70.7 - 70.8	37.5 - 2,600	69.6
Iron	0.264 - 2.15	4.57 - 1,180	0.508 - 6.0
Lead	ND	ND - 0.047	ND - 0.0028
Magnesium	26.1 - 26.2	81.8 - 706	26.0
Manganese	0.034 - 0.404	0.104 - 22	0.046 - 0.258
Nickel	ND	0.06 - 0.589	ND - 0.041
Potassium	4.29 - 4.36	49.5 - 692	5.6
Sodium	13.9 - 14.1	1450 - 3,280	21.4
Tin	ND - 0.023	ND - 0.035	ND - 0.022
Zinc	0.021 - 0.031	0.1 - 44.2	0.027 - 0.029

continued....

ATTACHMENT E

RISK ANALYSES

TABLE 8.3

SUMMARY OF MUTTON CREEK SEDIMENT ANALYTICAL DATA

Parameter	Upstream	Downstream
VOCs		
2-butanone (ug/kg)	ND	ND - 12
acetone (ug/kg)	ND	ND - 126
methylene chloride (ug/kg)	ND - 16	ND - 19
toluene (ug/kg)	ND - BDL	ND - 7
other VOCs	ND	ND
BNAs		
di-n-octylphthalate (ug/kg)	130	ND
other BNAs	ND	ND
Pesticide/PCBs		
all parameters	ND	ND
Metals		
Aluminum (mg/kg)	1,630	1,320 - 2,710
Arsenic (mg/kg)	13	ND
Barium (mg/kg)	12 - 52	12 - 27
Calcium (mg/kg)	87,900	15,100 - 45,200
Chromium (mg/kg)	6.5	ND
Cobalt (mg/kg)	ND - 4.5	ND
Copper (mg/kg)	ND - 5.1	ND - 2.9
Iron (mg/kg)	6,820 - 7,140	2,900 - 7,910
Lead (mg/kg)	9.9 - 13	3.5 - 6.1
Magnesium (mg/kg)	49,600	6,450 - 21,800
Manganese (mg/kg)	246 - 294	76 - 157
Nickel (mg/kg)	ND - 5	2.4 - 9.3
Potassium (mg/kg)	ND	ND - 682
Sodium (mg/kg)	415	324 - 437
Tin (mg/kg)	8.9	9.8 - 10
Total Cyanide (mg/kg)	ND	ND - 0.37
Zinc (mg/kg)	20 - 42	20 - 34

Notes:

(1) BDL - detected but below detection limit
(2) ND - not detected
(3) upstream data represented by locations SD3 and SS101
(4) downstream data represented by locations SS301 and SD1
(5) complete sediment data base provided in Appendix C.

Table 5 (continued)

Peak Risk (On Site)

Vinyl Chloride	5.2×10^{-6}
Benzene	1.5×10^{-7}
Trichloroethene	4.2×10^{-8}
Tetrachloroethene	4.4×10^{-8}
Styrene	3.6×10^{-9}
Methylene Chloride	2.3×10^{-7}
Total Peak Risk	5.6×10^{-6}*

*The sum of the peak risk for each chemical may not add up to total peak risk becuase of round-off error

Table 5

Peak Risks Associated With the Area Source/Typical Gas Generation Rate Scenario

Peak Risk Off Site

Vinyl Chloride	4.7×10^{-6}
Benzene	1.2×10^{-7}
Trichloroethene	3.3×10^{-8}
Tetrachloroethene	3.4×10^{-8}
Styrene	3.3×10^{-9}
Methylene Chloride	1.8×10^{-7}
Total Peak Risk	4.4×10^{-6}*

Peak Risk Residence

Vinyl Chloride	2.4×10^{-6}
Benzene	6.8×10^{-8}
Trichloroethene	1.9×10^{-8}
Tetrachloroethene	2.0×10^{-8}
Styrene	1.6×10^{-9}
Methylene Chloride	1.1×10^{-7}
Total Peak Risk	2.6×10^{-6}

*The sum of the peak risk for each chemical may not add up to total peak risk because of round-off error

REPLACEMENT TABLE 4.18

Total Potency of Liver Carcinogens in Upper Aquifer Downgradient Wells

Parameter	Aquifer Average Conc. ug/l	Daily Intake	Potency Factor	Risk
1,2-Dichloroethane	0.7	2x10-5	0.091	1.82x10-6
1,1-Dichloroethene	ND	-	0.58	-
Tetrachloroethane	0.9	1.6x10-5	0.051	1.31x10-6
Trichloroethene	0.6	1.7x10-5	0.011	0.19x10-6
Vinyl Chloride	1.2	3.4x10-5	2.3	78.2x10-6
Total				8.15x10-5

Replacement Table 4.20

Total Potency of Liver Carcinogens in Upper Aquifer On-Site Perimeter Wells

1,2-Dichloroethane	1.4	4x10-5	0.091	3.6x10-6
1,1-Dichloroethene	ND**	-	0.58	-
Tetrachloroethene	4.0	11.4x10-5	0.051	5.8x10-6
Trichloroethene	2.2	6.3x10-5	0.011	0.7x10-6
Vinyl Chloride	2.7	7.7x10-5	2.3	177.4x10-6
				1.9x10-4

*Daily intake assuming 2 liters/day by a 70 kg individual.

** 1.7 ug/l value in Table 4.20 of FS was a mistake. Only one detection at 0.3 ug.l

(2) Benzene = ND

(3) Tetrachloroethylene = ND

(4) Trichloroethylene = ND

(5) Vinyl Chloride[3] = (0.0011 mg/l) (2 l/day/70 kg)
= 3.14×10^{-5} mg/kg/day
risk = (3.14×10^{-5}) (2.3)
= 7.2×10^{-5}

(6) N-Nitrosodiphenylamine = ND

Because vinyl chloride was the only chemical detected, total risk will not be estimated for Well 305B.

Well OW402

(1) Arsenic[2] = (0.030 mg/l) (2 l/day/70 kg)
= 8.57×10^{-4} mg/kg/day
risk = (8.57×10^{-4}) (1.5)
= 1.3×10^{-3}

(2) Benzene = (0.0042 mg/l) (2 l/day/70 kg)
= 1.2×10^{-4} mg/kg/day
risk = (1.2×10^{-4}) (5.2×10^{-2})
= 6.2×10^{-6}

(3) Tetrachloroethylene = ND

(4) Trichloroethylene = (0.0008 mg/l) (2 l/day/70 kg)
= 2.29×10^{-5} mg/kg/day
risk = (2.29×10^{-5}) (1.1×10^{-2})
= 2.5×10^{-7}

(5) Vinyl Chloride[3] = (0.0007 mg/l) (2 l/day/70 kg)
= 2.0×10^{-5} mg/kg/day
risk = (2.0×10^{-5}) (2.3)
= 4.6×10^{-5}

(6) N-Nitrosodiphenylamine = ND

Total risk from mixture exposure for well OW402:

$(1.3 \times 10^{-3}) + (6.2 \times 10^{-6}) + (2.5 \times 10^{-7}) + (4.6 \times 10^{-5}) = 1.4 \times 10^{-3}$

Well OW403

(1) Arsenic = ND

(2) Benzene = ND

Calculations for the Estimation of
Total Risk From Mixture Exposure
Upper Aquifer Wells - Downgradient From
Wauconda Sand and Gravel[1]

Basic risk calculation:

(Dose	x	Human Ingestion Factor)	x	Potency Factor	=	Added Risk
mg/l		2 l/day/70 kg		$(mg/kg/day)^{-1}$		(Unitless)

Well G203A

(1) Arsenic[2] = (0.0072 mg/l) (2 l/day/70 kg)
$= 2.06 \times 10^{-4}$ mg/kg/day
risk = (2.06×10^{-4}) (1.5)
$= 3.1 \times 10^{-4}$

(2) Benzene = (0.0035 mg/l) (2 l/day/70 kg)
$= 1.0 \times 10^{-4}$ mg/kg/day
risk = (1.0×10^{-4}) (5.2×10^{-2})
$= 5.2 \times 10^{-6}$

(3) Tetrachloroethylene = ND

(4) Trichloroethylene = (0.0066 mg/l) (2 l/day/70 kg)
$= 1.89 \times 10^{-4}$ mg/kg/day
risk = (1.89×10^{-4}) (1.1×10^{-2})
$= 2.1 \times 10^{-6}$

(5) Vinyl Chloride[3] = (0.0007 mg/l) (2 l/day/70 kg)
$= 2.0 \times 10^{-5}$ mg/kg/day
risk = (2.0×10^{-5}) (2.3)
$= 4.6 \times 10^{-5}$

(6) N-Nitrosodiphenylamine = (0.0013 mg/l) (2 l/day/70 kg)
$= 3.71 \times 10^{-5}$ mg/kg/day
risk = (3.71×10^{-5}) (4.9×10^{-3})
$= 1.8 \times 10^{-7}$

Individual risks are added to estimate total risk from mixture exposure:

$(3.1 \times 10^{-4}) + (5.2 \times 10^{-6}) + (2.1 \times 10^{-6}) + (4.6 \times 10^{-5}) + (1.8 \times 10^{-7})$
$= 3.6 \times 10^{-4}$

Well 305B

(1) Arsenic = ND

Well OW406

(1) Arsenic = ND

(2) Benzene = ND

(3) Tetrachloroethylene = ND

(4) Trichloroethylene = ND

(5) Vinyl Chloride[3] = (0.0008 mg/l) (2 l/day/70 kg)
= 2.29×10^{-5} mg/kg/day
risk = (2.29×10^{-5}) (2.3)
= 5.3×10^{-5}

(6) N-Nitrosodiphenylamine = ND

Because vinyl chloride was the only chemical detected, total risk will not be estimated for Well OW406.

Well OW407

(1) Arsenic = ND

(2) Benzene = ND

(3) Tetrachloroethylene = ND

(4) Trichloroethylene = ND

(5) Vinyl Chloride = (0.0019 mg/l) (2 l/day/70 kg)
= 5.43×10^{-5} mg/kg/day
risk = (5.43×10^{-5}) (2.3)
= 1.2×10^{-4}

(6) N-Nitrosodiphenylamine = ND

Because vinyl chloride was the only chemical detected, total risk will not be estimated for Well OW407.

Well OW408

(1) Arsenic[2] = (0.005 mg/l) (2 l/day/70 kg)
= 1.43×10^{-4} mg/kg/day
risk = (1.43×10^{-4}) (1.5)
= 2.1×10^{-4}

(2) Benzene = ND

(3) Tetrachloroethylene = (0.0018 mg/l) (2 l/day/70 kg)
= 5.14×10^{-5} mg/kg/day
risk = (5.14×10^{-5}) (5.1×10^{-2})
= 2.6×10^{-6}

(3) Tetrachloroethylene = ND

(4) Trichloroethylene[3] = (0.0002 mg/l) (2 l/day/70 kg)
= 5.71×10^{-6} mg/kg/day
risk = (5.71×10^{-6}) (1.1×10^{-2})
= 6.3×10^{-8}

(5) Vinyl Chloride = (0.0028 mg/l) (2 l/day/70 kg)
= 8.0×10^{-5} mg/kg/day
risk = (8.0×10^{-5}) (2.3)
= 1.8×10^{-4}

(6) N-Nitrosodiphenylamine = ND

Total risk from mixture exposure for well OW403:

$(6.3 \times 10^{-8}) + (1.8 \times 10^{-4}) = 1.8 \times 10^{-4}$

Well OW404

(1) Arsenic = ND

(2) Benzene = ND

(3) Tetrachloroethylene = ND

(4) Trichloroethylene = ND

(5) Vinyl Chloride = ND

(6) N-Nitrosodiphenylamine = ND

No total risk estimated for Well OW404.

Well OW405

(1) Arsenic = ND

(2) Benzene = ND

(3) Tetrachloroethylene = ND

(4) Trichloroethylene = ND

(5) Vinyl Chloride = ND

(6) N-Nitrosodiphenylamine = ND

No total risk estimated for Well OW405.

Calculations for the Estimation of
Total Risk from Mixture Exposure
Upper Aquifer Wells -- On-site
Perimeter Wells for Wauconda
Sand and Gravel[1]

Well G112

(1) Arsenic[2] = (0.0064 mg/l) (2 l/day/70 kg)
= 1.83×10^{-4} mg/kg/day
risk = (1.83×10^{-4}) (1.5)
= 2.7×10^{-4}

(2) Benzene[3] = (0.0031 mg/l) (2 l/day/70 kg)
= 8.86×10^{-5} mg/kg/day
risk = (8.86×10^{-5}) (5.2×10^{-2})
= 4.6×10^{-6}

(3) Tetrachloroethylene = ND

(4) Trichloroethylene = ND

(5) Vinyl Chloride = (0.0011 mg/l) (2 l/day/70 kg)
= 3.14×10^{-5} mg/kg/day
risk = (3.14×10^{-5}) (2.3)
= 7.2×10^{-5}

(6) N-Nitrosodiphenylamine = ND

Total risk from mixture exposure for Well G112:

$(2.7 \times 10^{-4}) + (4.6 \times 10^{-6}) + (7.2 \times 10^{-5}) = 3.5 \times 10^{-4}$

Well G113

(1) Arsenic = ND

(2) Benzene = ND

(3) Tetrachloroethylene = ND

(4) Trichloroethylene = ND

(5) Vinyl Chloride = ND

(6) N-Nitrosodiphenylamine = ND

No total risk estimated for Well G113.

(4) Trichloroethylene = ND

(5) Vinyl Chloride = (0.0016 mg/l) (2 l/day/70 kg)
= 4.57×10^{-5} mg/kg/day
risk = (4.57×10^{-5}) (2.3)
= 1.1×10^{-4}

(6) N-Nitrosodiphenylamine = ND

Total risk from mixture exposure for Well OW408:

$(2.1 \times 10^{-4}) + (2.6 \times 10^{-6}) + (1.1 \times 10^{-4}) = 3.2 \times 10^{-4}$

(3) Tetrachloroethylene[3] = (0.0017 mg/l) (2 l/day/70 kg)
= 4.86×10^{-5} mg/kg/day
risk = (4.86×10^{-5}) (5.1×10^{-2})
= 2.5×10^{-6}

(4) Trichloroethylene = (0.0021 mg/l) (2 l/day/70 kg)
= 6.0×10^{-5} mg/kg/day
risk = (6.0×10^{-5}) (1.1×10^{-2})
= 6.6×10^{-7}

(5) Vinyl Chloride = (0.0022 mg/l) (2 l/day/70 kg)
= 6.29×10^{-5} mg/kg/day
risk = (6.29×10^{-5}) (2.3)
= 1.4×10^{-4}

(6) N-Nitrosodiphenylamine = ND

Total risk from mixture exposure for Well G201:

$(1.2 \times 10^{-3}) + (3.9 \times 10^{-6}) + (2.5 \times 10^{-6}) + (6.6 \times 10^{-7}) + (1.4 \times 10^{-4})$
$= 1.3 \times 10^{-3}$

Well G303A

(1) Arsenic = ND

(2) Benzene = ND

(3) Tetrachloroethylene = ND

(4) Trichloroethylene = ND

(5) Vinyl Chloride = ND

(6) N-Nitrosodiphenylamine = ND

No total risk estimated for Well G303A.

Well G303B

(1) Arsenic[2] = (0.004 mg/l) (2 l/day/70 kg)
= 1.14×10^{-4} mg/kg/day
risk = (1.14×10^{-4}) (1.5)
= 1.7×10^{-4}

(2) Benzene = ND

(3) Tetrachloroethylene = ND

(4) Trichloroethylene = ND

Well G114

(1) Arsenic[2] = (0.028 mg/l) (2 l/day/70 kg)
= 8.0×10^{-4} mg/kg/day
risk = (8.0×10^{-4}) (1.5)
= 1.2×10^{-3}

(2) Benzene = (0.0054 mg/l) (2 l/day/70 kg)
= 1.54×10^{-4} mg/kg/day
risk = (1.54×10^{-4}) (5.2×10^{-2})
= 8.0×10^{-6}

(3) Tetrachloroethylene = ND

(4) Trichloroethylene = ND

(5) Vinyl Chloride[3] = (0.0008 mg/l) (2 l/day/70 kg)
= 2.29×10^{-5} mg/kg/day
risk = (2.29×10^{-5}) (2.3)
= 5.3×10^{-5}

(6) N-Nitrosodiphenylamine = ND

Total risk from mixture exposure for Well G114:

$(1.2 \times 10^{-3}) + (8.0 \times 10^{-6}) + (5.3 \times 10^{-5}) = 1.3 \times 10^{-3}$

Well G117

(1) Arsenic = ND

(2) Benzene = ND

(3) Tetrachloroethylene = ND

(4) Trichloroethylene = ND

(5) Vinyl Chloride = ND

(6) N-Nitrosodiphenylamine = ND

No total risk estimated for Well G117.

Well G201

(1) Arsenic[2] = (0.027 mg/l) (2 l/day/70 kg)
= 7.71×10^{-4} mg/kg/day
risk = (7.71×10^{-4}) (1.5)
= 1.2×10^{-3}

(2) Benzene = (0.0026 mg/l) (2 l/day/70 kg)
= 7.43×10^{-5} mg/kg/day
risk = (7.43×10^{-5}) (5.2×10^{-2})
= 3.9×10^{-6}

(5) Vinyl Chloride = (0.0091 mg/l) (2 l/day/70 kg)
= 2.6×10^{-4} mg/kg/day
risk = (2.6×10^{-4}) (2.3)
= 5.98×10^{-4}

(6) N-Nitrosodiphenylamine = ND

Total risk from mixture exposure for Well G310:

$(1.9 \times 10^{-6}) + (2.9 \times 10^{-7}) + (6.9 \times 10^{-7}) + (5.98 \times 10^{-4}) = 6.0 \times 10^{-4}$

(5) Vinyl Chloride = (0.0017 mg/l) (2 l/day/70 kg)
= 4.86×10^{-5} mg/kg/day
risk = (4.86×10^{-5}) (2.3)
= 1.1×10^{-4}

(6) N-Nitrosodiphenylamine = ND

Total risk from mixture exposure for Well G3[illegible]:

$(1.7 \times 10^{-4}) + (1.1 \times 10^{-4}) = 2.8 \times 10^{-4}$

Well G304

(1) Arsenic[2] = (0.042 mg/l) (2 l/day/70 kg)
= 1.2×10^{-3} mg/kg/day
risk = (1.2×10^{-3}) (1.5)
= 1.8×10^{-3}

(2) Benzene = (0.0028 mg/l) (2 l/day/70 kg)
= 8.0×10^{-5} mg/kg/day
risk = (8.0×10^{-5}) (5.2×10^{-2})
= 4.2×10^{-6}

(3) Tetrachloroethylene = ND

(4) Trichloroethylene = ND

(5) Vinyl Chloride = ND

(6) N-Nitrosodiphenylamine = ND

Total risk from mixture exposure for Well G304:

$(1.8 \times 10^{-3}) + (4.2 \times 10^{-6}) = 1.8 \times 10^{-3}$

Well G310

(1) Arsenic = ND

(2) Benzene = (0.0013 mg/l) (2 l/day/70 kg)
= 3.7×10^{-5} mg/kg/day
risk = (3.7×10^{-5}) (5.2×10^{-2})
= 1.9×10^{-6}

(3) Tetrachloroethylene[3] = (0.0002 mg/l) (2 l/day/70 kg)
= 5.71×10^{-6} mg/kg/day
risk = (5.71×10^{-6}) (5.1×10^{-2})
= 2.9×10^{-7}

(4) Trichloroethylene = (0.0022 mg/l) (2 l/day/70 kg)
= 6.29×10^{-5} mg/kg/day
risk = (6.29×10^{-5}) (1.1×10^{-2})
= 6.9×10^{-7}

Calculations for the Estimation of
Total Risk from Mixture Exposure
Lower Aquifer Wells for Wauconda
Sand and Gravel[1]

Well 311B

(1) Arsenic = ND

(2) Benzene[3] = (0.0044 mg/l) (2 l/day/70 kg)
= 1.26×10^{-4} mg/kg/day
risk = (1.26×10^{-4}) (5.2×10^{-2})
= 6.6×10^{-6}

(3) Tetrachloroethylene = ND

(4) Trichloroethylene = ND

(5) Vinyl Chloride = ND

(6) N-Nitrosodiphenylamine = ND

Because benzene was the only chemical detected, total risk will not be estimated for Well 311B.

Well OW409

(1) Arsenic = ND

(2) Benzene = ND

(3) Tetrachloroethylene[3] = (0.0008 mg/l) (2 l/day/70 kg)
= 2.29×10^{-5} mg/kg/day
risk = (2.29×10^{-5}) (5.1×10^{-2})
= 1.2×10^{-6}

(4) Trichloroethylene = (0.012 mg/l) (2 l/day/70 kg)
= 3.43×10^{-4} mg/kg/day
risk = (3.43×10^{-4}) (1.1×10^{-2})
= 3.8×10^{-6}

(5) Vinyl Chloride = ND

(6) N-Nitrosodiphenylamine = ND

Total risk from mixture exposure for Well OW409:

$(1.2 \times 10^{-6}) + (3.8 \times 10^{-6}) = 5.0 \times 10^{-6}$

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Well OW410

(1) Arsenic = ND

(2) Benzene = ND

(3) Tetrachloroethylene[3] = (0.0006 mg/l) (2 l/day/70 kg)
= 1.71×10^{-5} mg/kg/day
risk = (1.71×10^{-5}) (5.1×10^{-2})
= 8.7×10^{-7}

(4) Trichloroethylene = (0.0039 mg/l) (2 l/day/70 kg)
= 1.11×10^{-4} mg/kg/day
risk = (1.11×10^{-4}) (1.1×10^{-2})
= 1.2×10^{-6}

(5) Vinyl Chloride = ND

(6) N-Nitrosodiphenylamine = (0.014 mg/l) (2 l/day/70 kg)
= 4×10^{-4} mg/kg/day
risk = (4×10^{-4}) (4.9×10^{-3})
= 1.96×10^{-6}

Total risk from mixture exposure for Well OW410:

$(8.7 \times 10^{-7}) + (1.2 \times 10^{-6}) + (1.96 \times 10^{-6}) = 4.0 \times 10^{-6}$

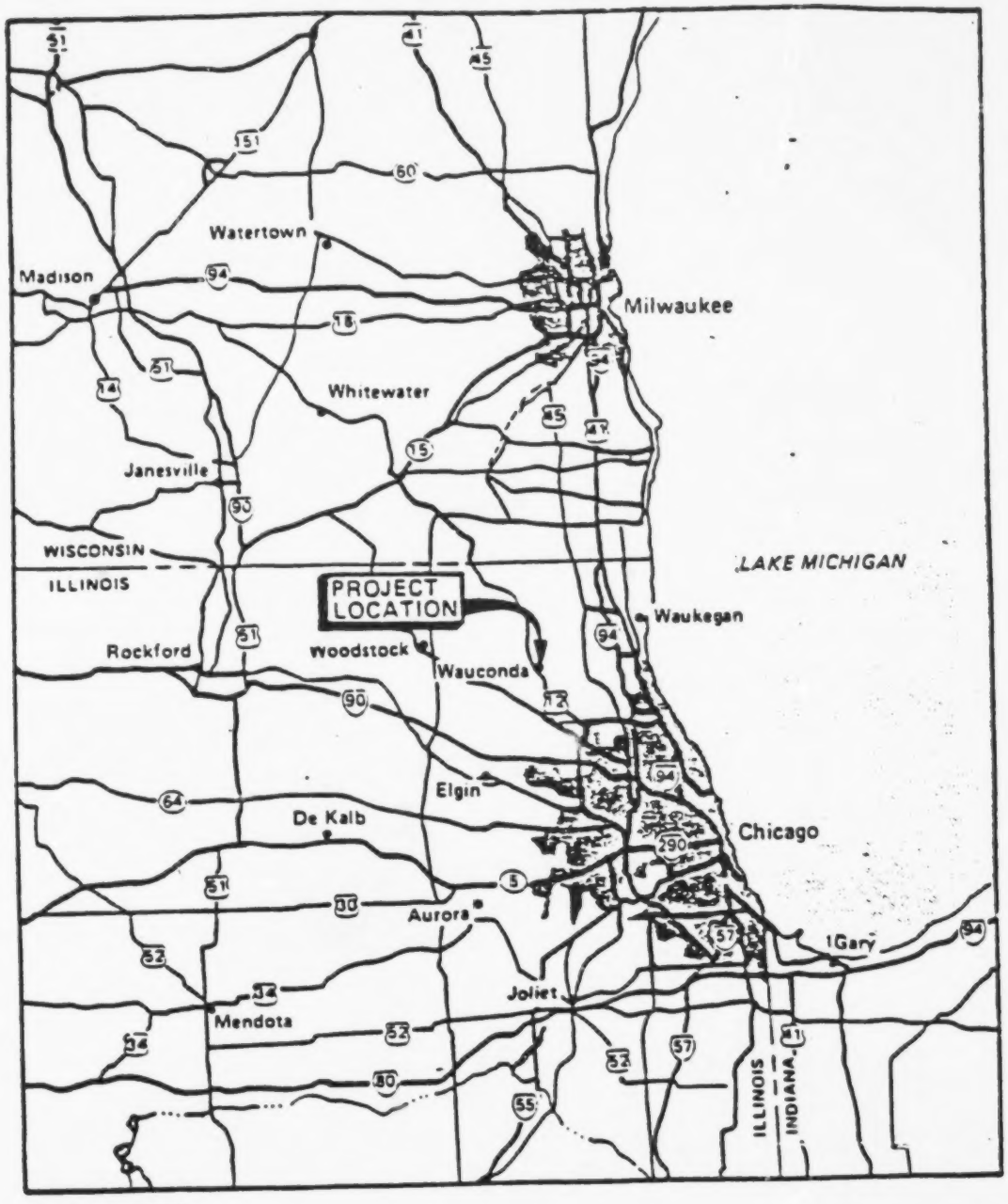


FIGURE 1 A
SITE LOCATION MAP

FIGURES

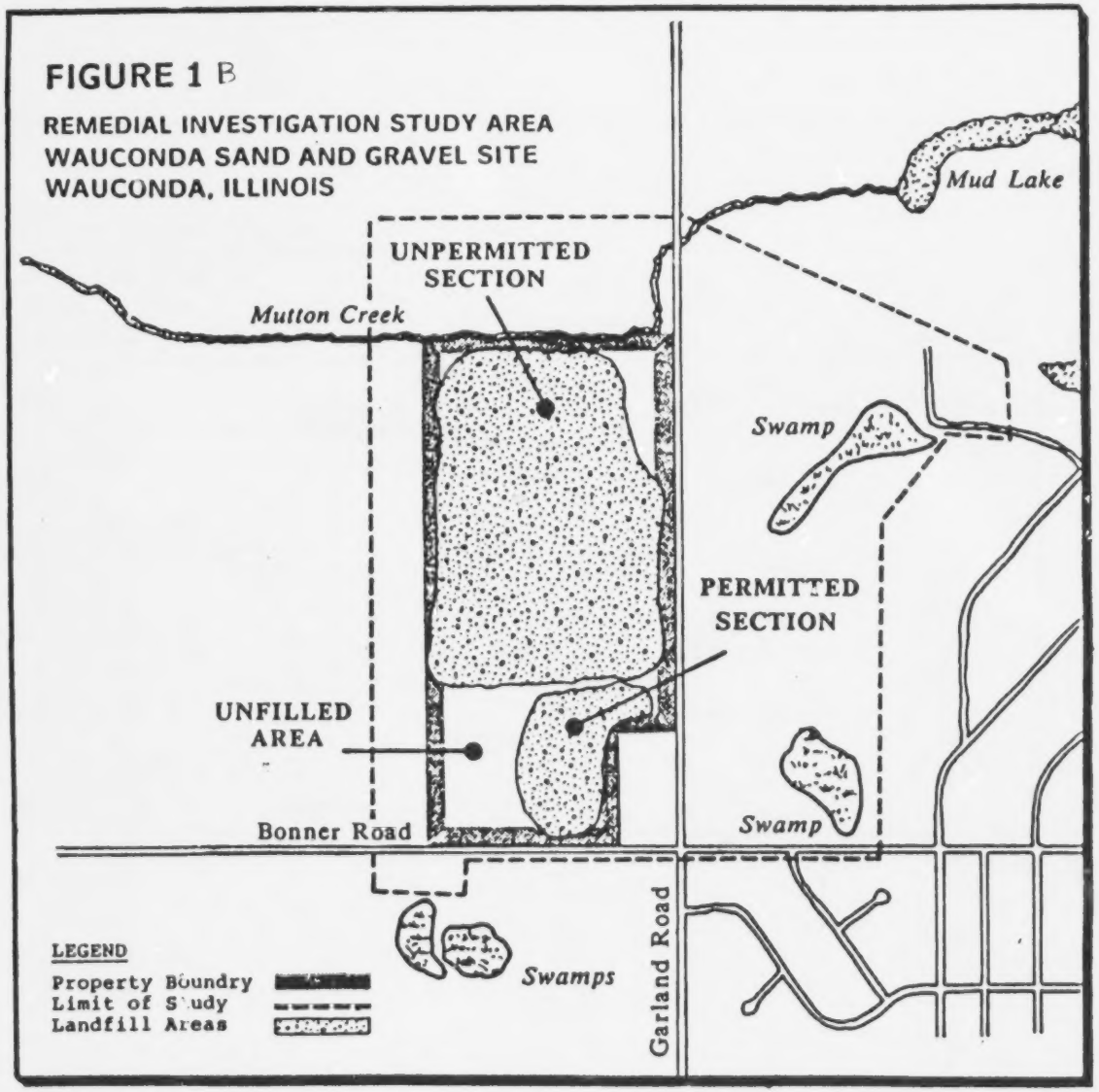
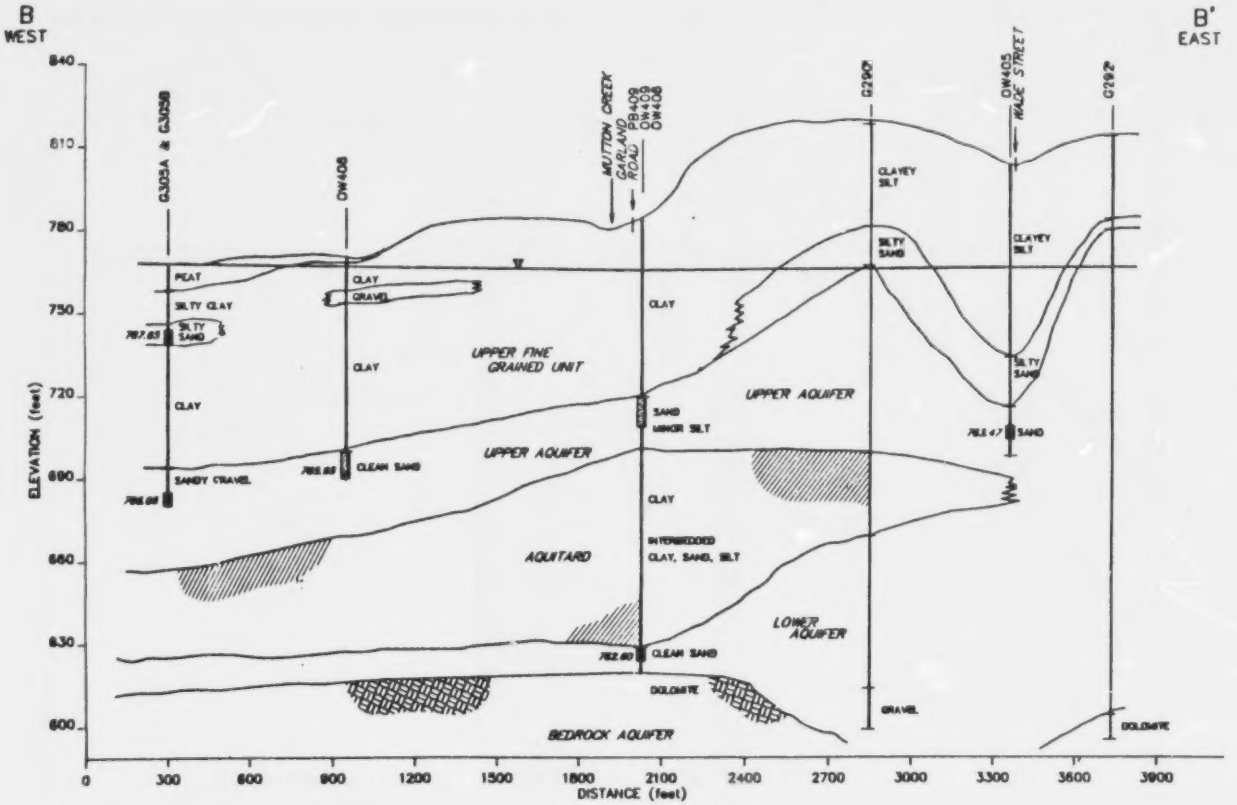


FIGURE 1 B
REMEDIAL INVESTIGATION STUDY AREA
WAUCONDA SAND AND GRAVEL SITE
WAUCONDA, ILLINOIS
Mud Lake
UNPERMITTED SECTION
Mutton Creek
Swamp
PERMITTED SECTION
UNFILLED AREA
Bonner Road
Swamp
Swamps
Garland Road
LEGEND
Property Boundry
Limit of Study
Landfill Areas



NOTE:

1) • GAMMA LOGGED WELL

2) WATER LEVELS RECORDED ON NOVEMBER 20, 1986

▽ UPPER AQUIFER WATER LEVEL

figure 3
GEOLOGIC CROSS-SECTION B-B'
Wauconda Landfill Site

CRA

1449-40-30/10/87-28-0-1

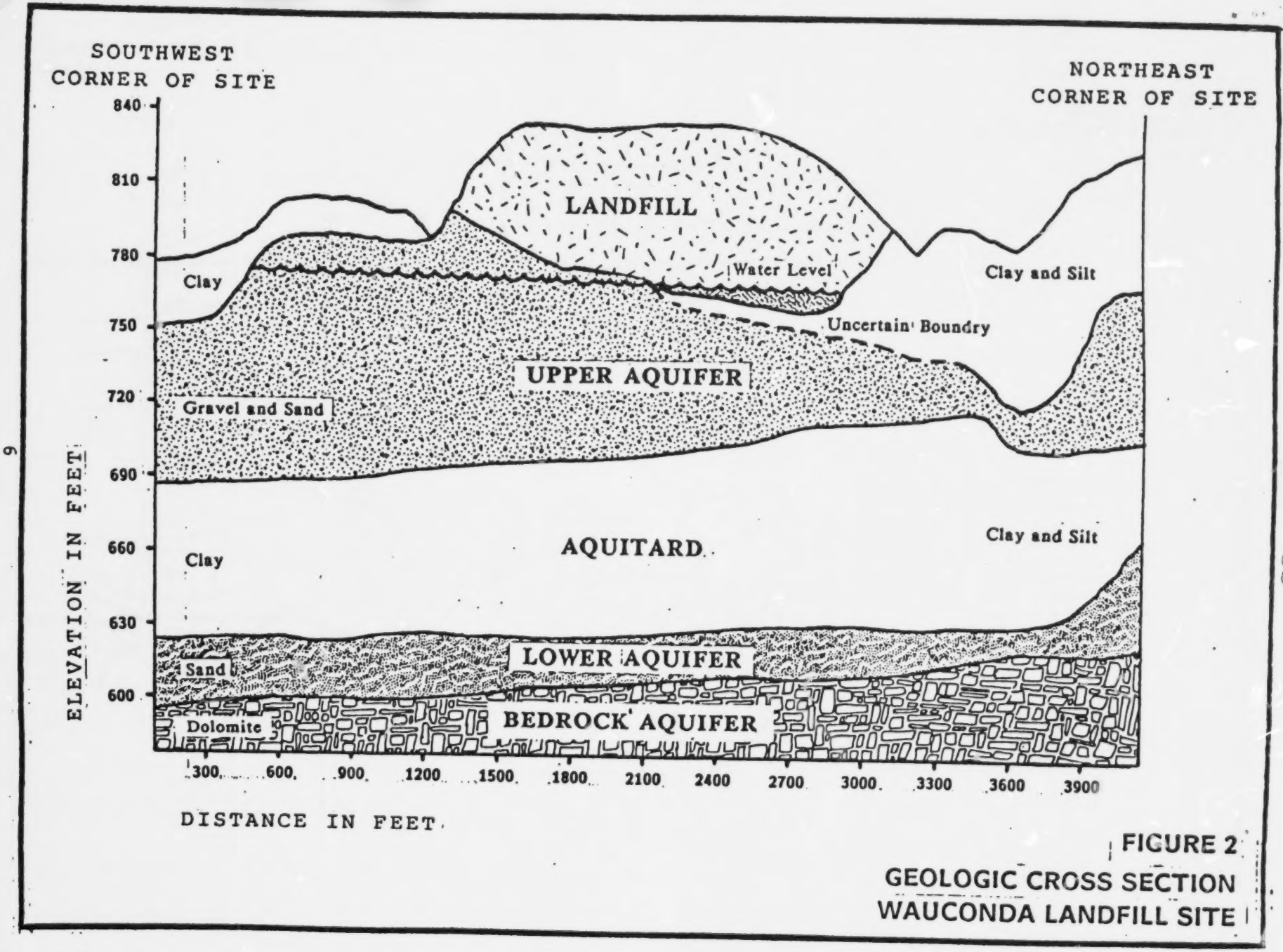


FIGURE 2
GEOLOGIC CROSS SECTION
WAUCONDA LANDFILL SITE

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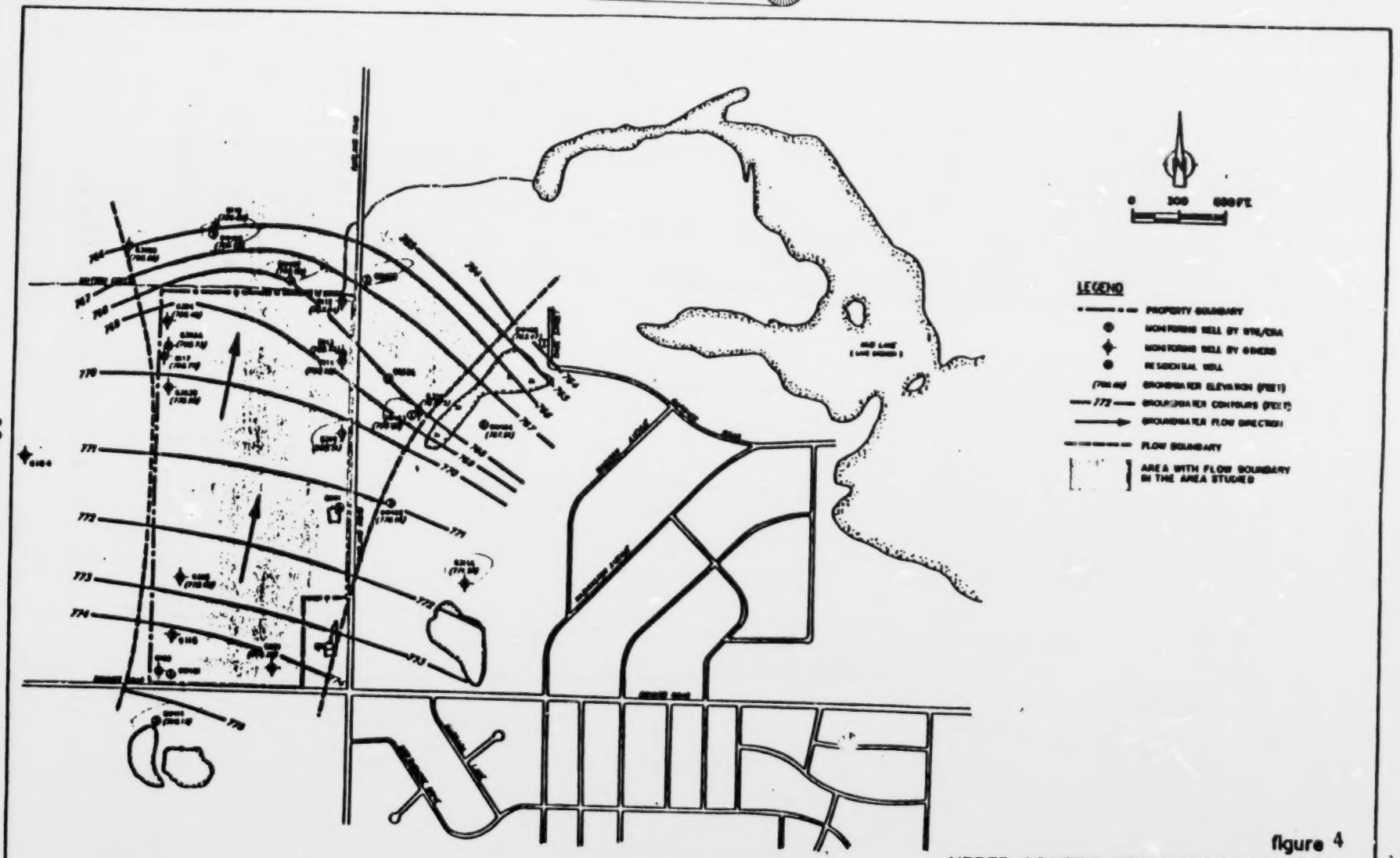

figure 4
UPPER AQUIFER GROUNDWATER CONTOURS
NOVEMBER 20, 1986
Wauconda Landfill Site

CRA

1448-40-27/04/87-28-0-2

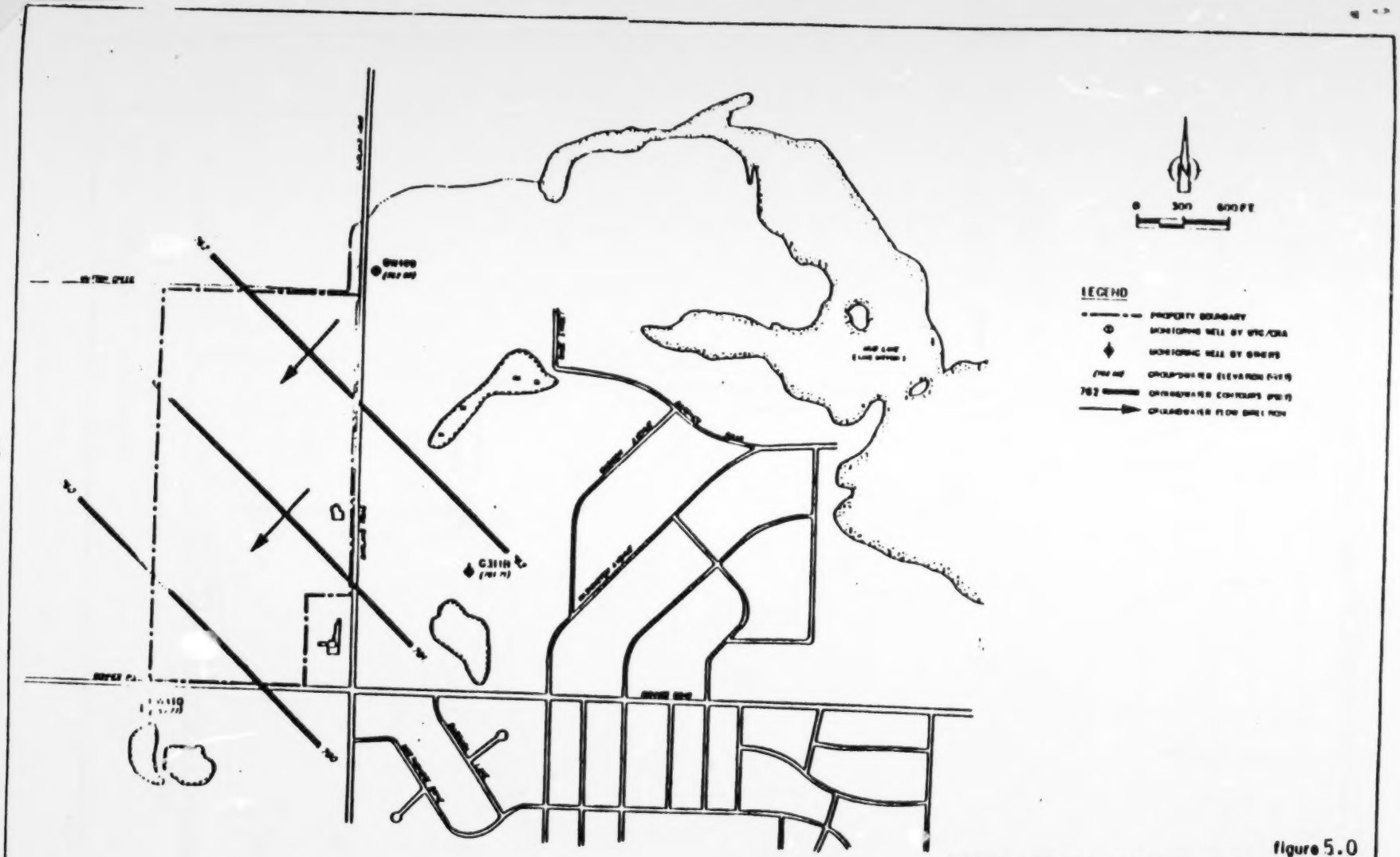

figure 5.0
LOWER AQUIFER GROUNDWATER CONTOURS
NOVEMBER 20, 1986
Wauconda Landfill Site

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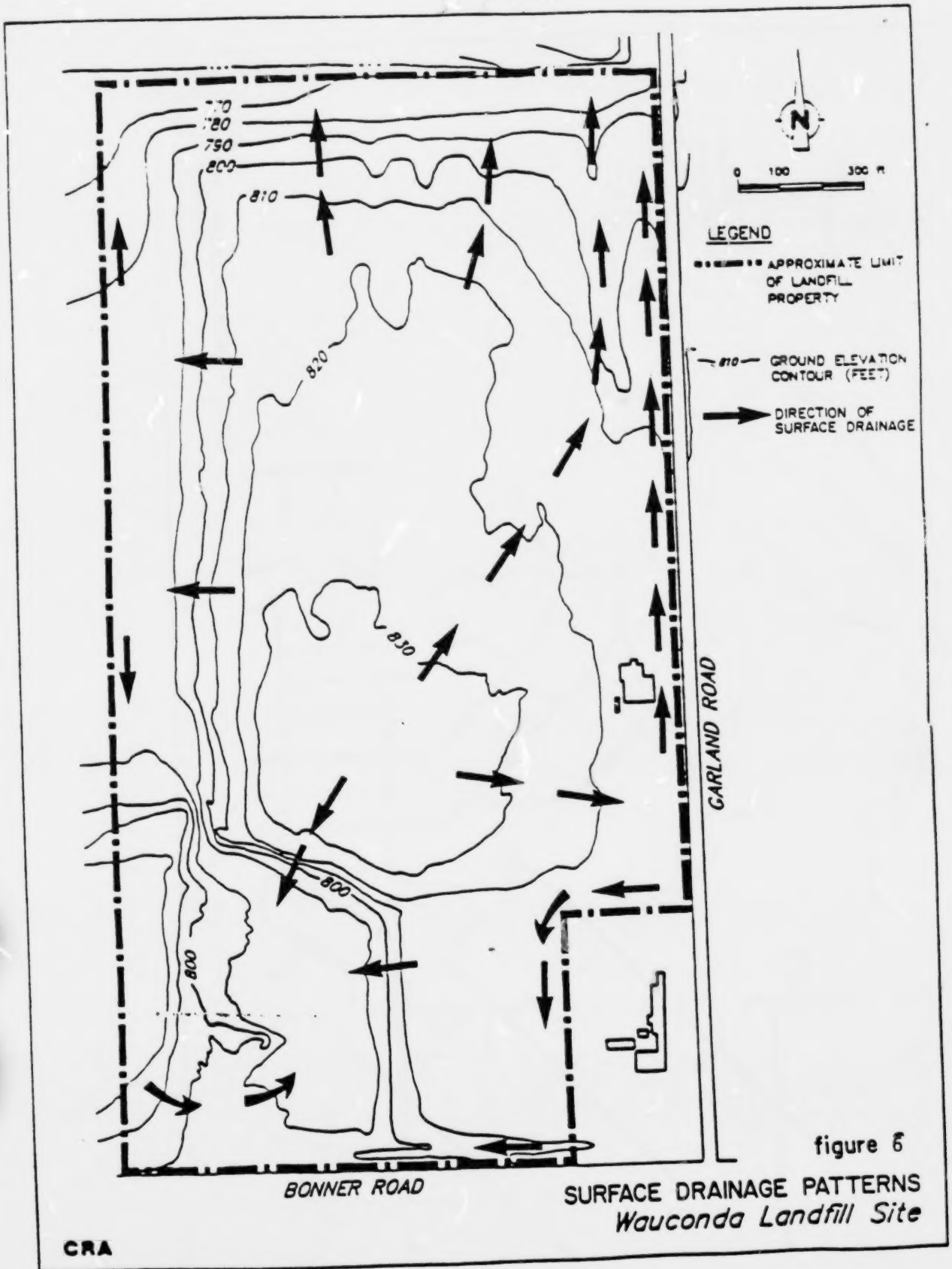

figure 6

SURFACE DRAINAGE PATTERNS
Wauconda Landfill Site

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